DUAL LITE

Installation Instructions and User Manual

For

LSN

LIFE SAFETY NETWORK

Inverter Power Systems

1.0 - 17.5 KVA

READ AND FOLLOW ALL SAFETY INSTRUCTIONS

IMPORTANT SAFEGUARDS

When using electrical equipment, you should always follow basic safety precautions, including the following:

1. ***Read and follow all safety instructions.***
2. ***Do not install the LSN (Life Safety Network) inverter system outdoors.***
3. ***Do not install near gas or electric heaters or in other high-temperature locations.***
4. ***Use caution when servicing batteries. Battery acid can cause burns to skin and eyes. If acid is spilled on skin or in the eyes, flush with fresh water and contact a physician immediately.***
5. ***Equipment should be mounted in locations where it will not be readily subjected to tampering by unauthorized personnel.***
6. ***The use of accessory equipment not recommended by the manufacturer may cause an unsafe condition and may void the warranty.***
7. ***Do not use this equipment for other than intended use.***
8. ***All servicing of this equipment must be performed by qualified service personnel.***

SAVE THESE INSTRUCTIONS
IMPORTANT SAFETY INSTRUCTIONS

The installation and use of this product must comply with all national, federal, state, municipal, or local codes that apply.

Please read this manual thoroughly before operating the LSN Inverter System.

For technical assistance, contact Dual-Lite's Systems Technical Support Center at 1-800-848-6439.
Technicians are available during normal working hours (EST).

Table of Contents

Section 100 System Installation Instructions

Description **Page**

101. Unit Specifications 4
102. Receiving, Moving and Storing Systems and Batteries 5
102.1 Shipping Damage 5
102.2 Moving Units and Batteries 5
102.3 Temporary Storage of Units and Batteries 5
103. Installation Requirements 6
103.1 Operating Environment 6
103.2 High Altitude Operation 6
104. Cabinet Mounting (Physical) 7
104.1 Dimensions 7
104.2 Standard Cabinet Configurations 7
104.3 Cabinet Installation 8,9
105. Battery Installation and Connection 10
105.1 Tools 11
105.2 Installation Considerations 12
105.3 Battery Installation Procedure 12-16
105.4 DC Fuse Installation 17
105.5 Electronics Cabinet Voltage Check 17
106. AC Connections 18
106.1 AC Wiring Preparations 18
106.2 AC Input and AC Output Connections 19
107. RS-232 Communications Connections 20
108. Final Installation Checklist 20
109. Maintenance Bypass Switch Phase Check 21
110. System Start-Up Procedure 22
111. System Verification 22

Section 200 User Manual

Description **Page**

201. User Interface Panel 23
201.1 User interface Panel Basics 23
201.2 Using The Interface Panel 24
201.3 How To Display A Parameter 24
201.4 How to Clear A User Password 24
201.5 How o Change A Parameter Value 24
201.6 How to Change Operating Modes 25
201.7 Parameter "Hot Key" Listing By Function 26,27
202. System Diagnostics 28
203. System Auto Testing 28
203.1 Weekly Test 28
203.2 Monthly Test 28
203.3 Annual Test 28
203.4 Extended Power Outages 28
203.5 Performing A Manual Test 29
204. Stored Test Results (Logs) 29
205. Alarms 31
206. Communications 33
207. Unit Communication Options 33
208. Service Options 34

Section 300 Maintenance, Warranty and Technical Support

300. Maintenance 35
300.1 Safe Shut Down Procedure 35
300.2 Routine System Maintenance 36
300.3 Changing Air Filters 36
300.4 Battery Maintenance and Replacement 37-39
301. Warranty Information 39
302. Technical Service and Support 39

Appendix 1 40

Section 100 System Installation Instructions
101 Specifications

Input
- Input voltage: 120, 208, 240, 277or 347VAC +10-15%. Other voltages available on request
- Input frequency: 60Hz ±3%
- Synchronizing slew rate: 1 Hz per second nominal
- Input lightning protection: Meets ANSI 62.41, UL 924 and UL 1778 requirements

Output
- Output voltage: 120, 240, 277, 240/120, 277/120 or 347VAC. Other voltages available upon request
- Output regulation: (static) ±5% based on a 5% - 100% resistive load
- Minimum loading: none required
- Output distortion: Less than 5% THD linear load
- Load power factor: .75 lag to .8 lead
- Output frequency: Normally, synchronized to utility, +.05 Hz during emergency
- Overload: 150% momentary, 120% for five minutes, 110% for ten minutes
- Time to transfer to inverter after a utility power failure: No break

Battery
- Battery charger: Fully automatic and temperature compensated with internal diagnostic indicators
- Recharge time: 24 hours
- Battery protection: Automatic low-battery voltage disconnect. Automatic restart upon utility return
- Battery switch: Also used as battery isolator
- Standard battery: **"S"** - Sealed lead-calcium: 10-year life
- Optional batteries:
  "G" - Sealed lead-calcium: 20-year life
  "N" - Wet nickel-cadmium: 25-year life
- Battery voltage: 96VDC or 144VDC (system dependent)
- Runtimes: 90 minutes standard. Other runtimes available on request
- Operating temperature: 0°C to 40°C (32°F to 104°F)
- Relative humidity: 95% non-condensing

Note: Battery performance rated at 25°C (77°F)

Table 1.

KVA/KW Rating	1.0K	2.0K	2.7K	3.7K	4.8K	5.5K	6.6K	8.3K	10.0K	12.5K	15.0K	17.5K
Power Factor Rating	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag	.8 lead to .75 lag
Input/Output Voltage Combinations Available — Single Phase	Input VAC: 120, 208, 240, 277, 347 Output VAC: 120, 240, 277, 347, 120/240(1), 120/277 *Other voltages available; consult factory (2)*							Input VAC: 208, 240, 277, 347 (3) Output VAC: 120, 240, 277, 347, 120/240(1), 120/277 *Other voltages available; consult factory (2)*				
AC Input Voltage/ Input Circuit Breaker Rating	120/20A 208/15A 240/15A 277/15A 347/15A	120/30A 208/20A 240/15A 277/15A 347/15A	120/40A 208/25A 240/20A 277/20A 347/20A	120/50A 208/30A 240/25A 277/25A 347/20A	120/70A 208/40A 240/35A 277/30A 347/25A	120/70A 208/40A 240/35A 277/30A 347/25A	120/80A 208/50A 240/45A 277/40A 347/30A	— 208/70A 240/60A 277/50A 347/50A	— 208/80A 240/70A 277/60A 347/50A	— 208/100A 240/80A 277/70A 347/60A	— 208/125A 240/100A 277/90A 347/80A	— — — 277/100A 347/80A
Output Voltage and Maximum Output Current In Amperes	120/8.3 240/4.2 277/3.6 347/2.9	120/16.6 240/8.3 277/7.2 347/5.8	120/22.5 240/11.3 277/9.7 347/7.8	120/30.8 240/15.4 277/13.4 347/10.7	120/40.0 240/20.0 277/17.3 347/13.4	120/45.8 240/22.9 277/19.9 347/15.9	120/55.0 240/27.5 277/23.8 347/19.0	120/69.1 240/34.6 277/29.9 347/23.9	120/83.3 240/41.7 277/36.1 347/28.8	120/104.1 240/52.1 277/45.1 347/36.0	120/125 240/62.5 277/54.2 347/43.2	120/146 240/72.9 277/63.2 347/50.4
Standard Charger Size (Amperes)	5	5	5	5	10	10	10	10	10	15	15	15
System DC Voltage	96	96	96	96	96	96	96	144	144	144	144	144
Heat Output (BTU/Hr.)	175	350	473	648	840	963	1,155	1,453	1,750	2,188	2,625	3,063

*(1) On systems with 120/240VAC output, loading may not exceed 50% of the system's total KVA rating on any 120V leg. Loading beyond 50% on any 120V leg will cause an unsafe condition and **transformer failure will occur**. Call our Service Line at **800-848-6439** for alternate load connection configurations.*

(2) An external transformer may be required with certain input/output voltage configurations. Consult factory for details.

(3) Input voltage on 17.5KVA model limited to 277 and 347VAC only.

102. Receiving, Moving and Storing Systems and Batteries

102.1 Shipping Damage

LSN inverter systems and batteries are normally shipped separately.

Carefully inspect all cartons upon receipt for evidence of shipping damage.

Notify carrier immediately of leaking or damaged cartons for possible concealed damage.

All LSN electronics cabinet cartons are shipped with tip and vibration indicators.

Refuse all shipments in which the tip or vibration indicators have been activated.

102.2 Moving Units and Batteries

CAUTION: Batteries and LSN Electronics cabinets are very heavy. Proper equipment should always be used to move batteries and units to avoid damage and personal injury.

WARNINGS:

- ***ALWAYS WEAR PERSONAL EYE PROTECTION WHEN WORKING WITH BATTERIES - SEE PAGE 10***
- ***Batteries contain liquid caustic or acid electrolytes which CAN CAUSE SEVERE BURNS. Care must be taken when moving batteries to avoid tipping and spillage of electrolyte material.***

In case of accidental spill.

ANTIDOTE:

- ***EYES: Flush immediately with flowing water for at least 15 minutes. Seek medical attention.***
- ***EXTERNAL: Flush immediately with water. Seek medical attention.***

102.3 Temporary Storage of Units and Batteries

For temporary storage of LSN inverter systems and batteries prior to installation, select a clean, cool, dry location with normal ventilation for human habitation and level floors.

CAUTION: Batteries and LSN Electronics cabinets are very heavy. Check to assure that the floor in the temporary storage area is capable of safely bearing the load.

IMPORTANT:
Lengthy storage of batteries will cause irreversible damage to the cells.
Failure to connect LSN inverter system batteries to an energized charging circuit within 90 days from the date of shipment will void the battery warranty.

Storage Temperature:

Store all batteries at 0° to +40° C (32° to +104° F). Batteries will have a longer shelf life if stored at 25° C (77° F). The LSN electronics and battery cabinets may be stored at -20° to +60° C (-4° to +140° F).

Ventilation:

The air around the unit must be clean, dust-free, and free of corrosive chemicals or other contaminants. Do not place the LSN inverter system or batteries in a sealed room or container.

DANGER: EXPLOSIVE - CAN CAUSE BLINDNESS OR OTHER SEVERE INJURIES.
Every type of battery can produce hydrogen gas, even sealed, maintenance-free batteries. The gas is vented through the vent caps and into the air.
Do not allow smoking, sparks, or flames in battery storage location because hydrogen is concentrated under the vent cap of each cell of the battery. Hydrogen is highly explosive, and is hard to detect because it is colorless, odorless, and lighter than air.

103. Installation Requirements

103.1 Operating Environment

Install the LSN inverter system in a clean, cool, dry place with normal ventilation for human habitation and level floors.

CAUTION: Batteries and LSN Electronics cabinets are very heavy. Check to assure that the floor is capable of safely bearing the load.

Operating Temperature:

LSN inverter Systems are UL Listed for 20° to 30° C (+ 68° to +86° F) operation.
The LSN Inverter System has a designed operating range of 0° to +40° C (+32° to +104° F) at up to 95% relative humidity. Installation in environments at the temperature extremes of the designed operating range may effect unit performance or reduce service life.
Battery performance and service life is maximized if the operating temperature is maintained at 25° C (77° F) .

Ventilation:

The air around the unit must be clean, dust-free, and free of corrosive chemicals or other contaminants. Do not place the LSN inverter system or batteries in a sealed room or container.

Batteries:

The temperature should be near 25° C (77° F) for optimum battery performance.
Temperature Effect On Performance:
Batteries will be less efficient at temperatures below 18° C (65° F), and high temperatures will reduce battery life. Typically, at 35° C (95° F), battery life will be half of what it would be at normal temperature of 25° C (77° F). At 45° C (113° F), battery life will be one-fourth of normal.

WARNING: Every type of battery can produce hydrogen gas, even sealed, maintenance-free batteries. The gas is vented through the vent caps and into the air, mainly when the unit is charging the batteries. The batteries produce the most hydrogen when maximum voltage is present in fully charged batteries. The amount of current that the charger supplies to the batteries (not the battery ampere-hour) determines how much hydrogen is produced.
Do not allow smoking, sparks, or flames in battery storage location because hydrogen is concentrated under the vent cap of each cell of the battery. Hydrogen is highly explosive, and is hard to detect because it is colorless, odorless, and lighter than air.

⚠ CAUTION
NEVER INSTALL BATTERIES IN A SEALED ROOM OR ENCLOSURE

IMPORTANT:
Lengthy storage of batteries will cause irreversible damage to the cells.
Failure to connect LSN inverter system batteries to an energized charging circuit within 90 days from the date of shipment will void the battery warranty.

103.2 High Altitude Operation:

The maximum operating temperature drops 1° Celsius per 300 meters (2° F per 1000 feet) above sea level. Maximum elevation is 3000 meters (10,000 feet).

104. Cabinet Mounting

104.1 Dimensions

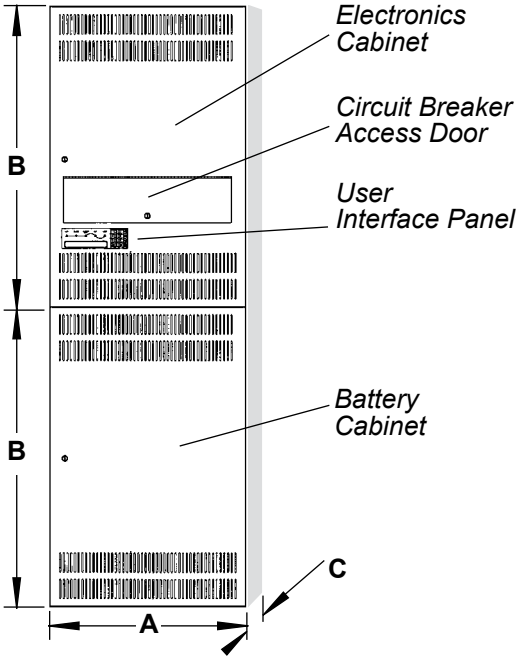


Table 104A - Dimensions: Unit and Battery Cabinets

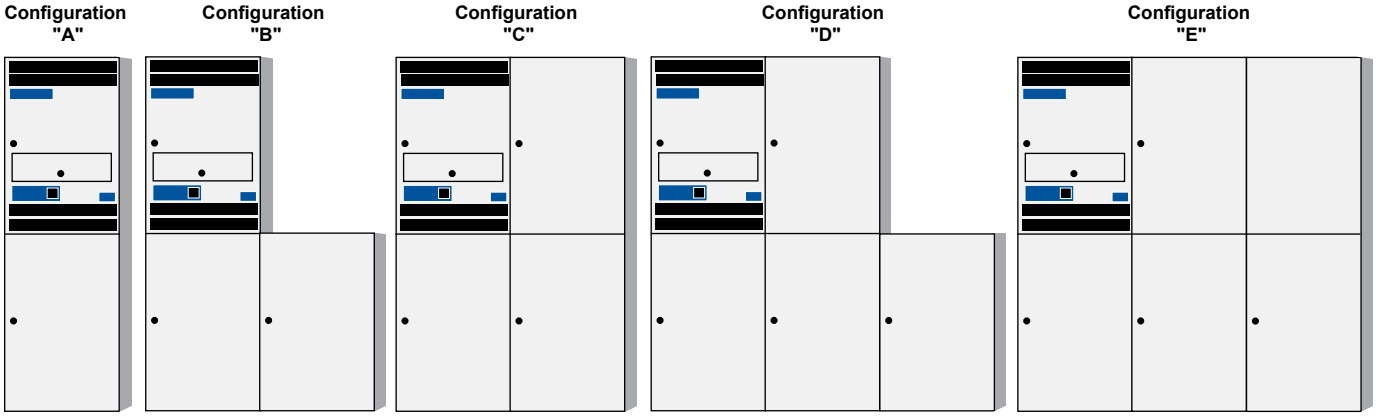
Width (A)	Height (B)	Depth (C)	Footprint
30 in. (76 cm)	46 in. (117 cm)	18.65 in (47 cm)	3.88 Ft^2 (.36 m^2)

Table 104B - Clearances Required:

Sides	Top	Front
0 in. (0 mm)	12 in. (31 cm)	30 in. (76 cm)

104.2 Standard Cabinet Configurations

IMPORTANT: If cabinets are installed in configurations other than those shown, factory supplied inter-cabinet connectors and battery cables may not fit.



Standard Battery Systems for 90-Minute Runtime

Type S Battery – Maintenance-Free Sealed Lead-Calcium – 10-Year Design Life Expectancy

System Capacity	1.0K	2.0K	2.7K	3.7K	4.8K	5.5K	6.6K	8.3K	10.0K	12.5K	15.0K	17.5K
System Configuration	A	A	A	A	A	B	B	B	B	B	C	C
Total Weight (lbs.) *	838	1,116	1,122	1,222	1,492	1,926	2,130	2,475	2,829	2,861	4,121	4,393

Type G Battery – Maintenance-Free Sealed Lead-Calcium – 20-Year Design Life Expectancy

System Capacity	1.0K	2.0K	2.7K	3.7K	4.8K	5.5K	6.6K	8.3K	10.0K	12.5K	15.0K	17.5K
System Configuration	A	A	A	A	B	B	B	B	B	D	D	D
Total Weight (lbs.) *	1,365	1,384	1,390	1,472	1,684	2,062	2,630	2,679	3,589	3,657	4,885	5,491

Type N Battery – Wet-Cell Nickel-Cadmium – 25-Year Design Life Expectancy

System Capacity	1.0K	2.0K	2.7K	3.7K	4.8K	5.5K	6.6K	8.3K	10.0K	12.5K	15.0K	17.5K
System Configuration	B	B	B	B	B	C	C	D	D	E	E	Consult
Total Weight (lbs.) *	1,075	1,486	1,644	1,894	2,232	2,532	2,812	3,481	3,940	4,720	5,505	Factory

** Approximate system weights*

104.3 Cabinet Installation

Based on the desired cabinet configuration for the application, remove the appropriate knockouts in the electronics and battery cabinets. See Figures 1, 2, 3, or 4 for the knockout locations.

Follow the general sequence below to install the cabinets.
CAUTION: Batteries and LSN Electronics cabinets are very heavy. Check to assure that the floor in the installation area is capable of safely bearing the load.

1. Locate all mounting hardware and chase/close nipples in the accessory box located inside the battery cabinet.
2. Arrange the lower cabinet(s) in their permanent location. If more than one cabinet is to be located on the lower level (Configuration B or C), fasten them together using the supplied 5/16-18 x 3/4" bolts. Locate the three mounting holes in the rear of the battery cabinet and use three bolts per cabinet to secure together. Install the supplied chase nipple and plastic bushing in the knockouts to connect the lower cabinets together.
3. Secure the supplied wall mounting brackets to the electronics cabinet (Configurations A and B), or to the outermost sides of the upper cabinets (Configuration C). Use three supplied 5/16-18 x 3/4" bolts per wall bracket.
   Note: *Only two wall mounting brackets are supplied with the system, normally intended to secure the upper cabinets to the wall. Consult the factory if additional brackets are needed to secure the lower cabinets to the wall.*
4. Place the upper cabinets in position and secure them together using the supplied 5/16-18 x 3/4" bolts. Locate the three mounting holes in the rear of the battery cabinet and use three bolts per cabinet to secure together.
5. Secure the upper cabinets to the lower cabinets using the supplied 5/16-18 x 1 1/2" bolts. Install from the floor of the upper cabinets into the top of the lower cabinets. Install the supplied close nipple and plastic bushing in the knockouts to connect the upper cabinets to the lower cabinets.
6. Secure the wall mounting brackets to the wall using an acceptable wall anchoring technique.

Fig. 1

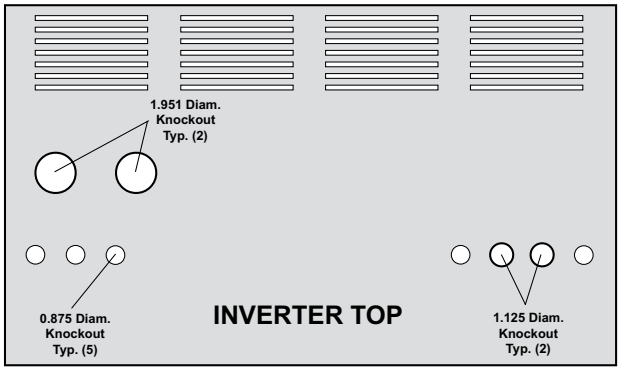


Fig. 2

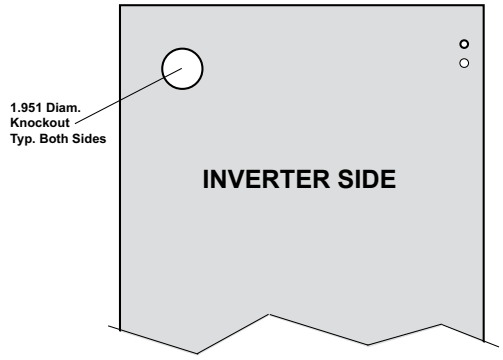


Fig. 3

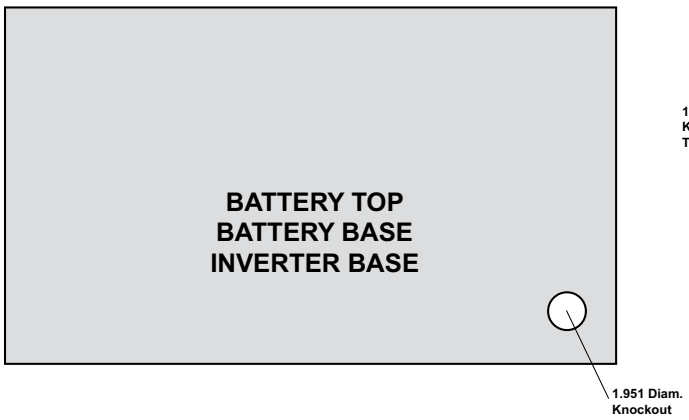
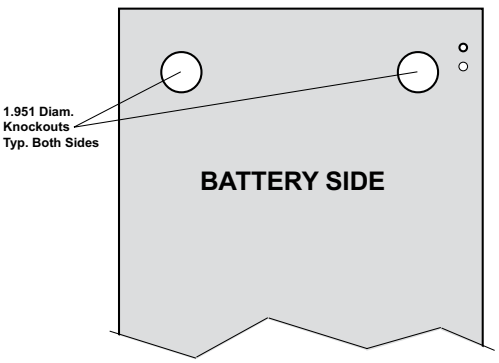
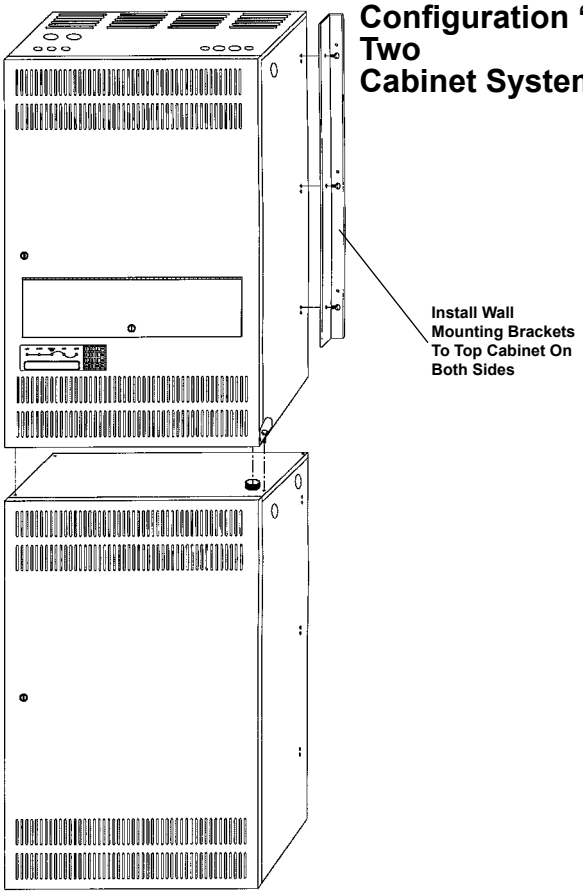


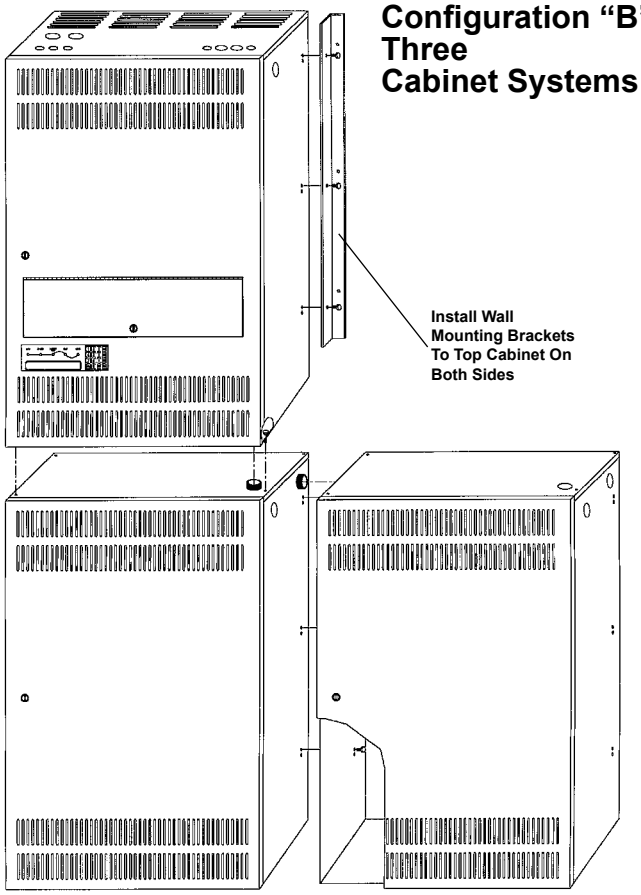
Fig. 4



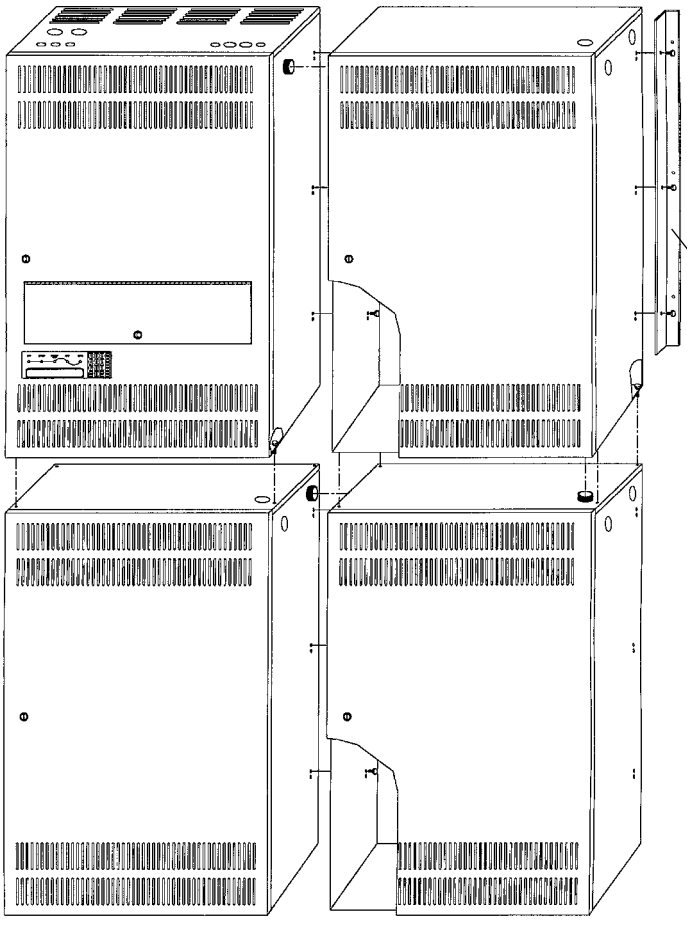
Configuration “A” Two Cabinet Systems



Configuration “B” Three Cabinet Systems



Configuration “C” Four Cabinet Systems



105. Battery Installation and Connection

Installing the Batteries and DC Wiring

Important Safety Precautions

The installer must take these precautions:

1. **Wear protective clothing, eye-wear, rubber gloves and boots. Batteries contain corrosive acids or caustic alkalis and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry. Don't carry metal objects in pockets where the objects can fall onto the batteries or into the LSN inverter system or battery cabinet.**

2. **Tools must have insulated handles so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at any time. Do not lay tools or metal parts on top of the batteries, and do not lay any objects where they could fall onto the batteries or into the cabinet.**

3. **Install the batteries as shown on the battery wiring diagram provided in this manual or with the battery cable kit. When connecting cables, never allow a cable to short across a battery's terminals, the string of batteries, or to the cabinet.**

4. **Align the cables on the battery terminals so that the cable lug will not contact any part of the cabinet even if the battery is moved. Keep the cable away from any sharp metal edges.**

5. **Install the battery cables so they cannot be pinched by the battery cabinet or the LSN inverter system doors.**

6. **External battery cabinet chassis ground (or earth) must be connected to the LSN inverter system unit's chassis ground (or earth). The ground conductor must be insulated. If you use conduit, this ground conductor must be routed in the same conduit as the battery conductors.**

7. **Where conductors may be exposed to physical damage, protect conductors in accordance with NEC requirements.**

8. **Full voltage and current are always present at the battery terminals. The batteries used in this system can produce dangerous voltages, extremely high currents, and possible risk of electric shock. Batteries may cause severe injury if the terminals are shorted together or to ground (earth). Be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminals during battery installation. Do not touch uninsulated battery terminals.**

9. **A qualified electrician who is familiar with battery systems and required precautions must install and service the batteries. Any battery used with this unit shall comply with the applicable requirements for batteries in the standard for emergency lighting and power equipment, UL 924. Cabinets are designed to be used with, and batteries must be replaced by identical cells or a Dual-Lite approved equivalent. If using substitute batteries not supplied by Dual-Lite, the unit's UL listing will be void, and the equipment may fail to perform properly. The installation must conform to national and local codes as well. Keep unauthorized personnel away from batteries.**

105.1 Tools

The following tools are required to install the system batteries. Other tools may be necessary if optional batteries have been ordered.

CAUTION: Always use insulated tools for battery installation. Always torque to the manufacturer's recommendations.

- **Petroleum Jelly**
- **Slotted Screwdriver**
- **3-inch Socket Extension**
- **Ratchet**
- **Electrical Tape**
- **Digital Volt-Ohm Meter**
- **1/2-inch Insulated Socket Wrench**
- **Safety Equipment Required by Local Codes**
- **Torque Wrench Calibrated in Inch-pounds or Newton-meters**
- **Brush (for applying conductive grease or petroleum jelly to terminals)**
- **Safety Glasses with Side Shields - See Page 10**

105.2 Installation Considerations

This section explains how to install the LSN system's batteries, fuses, and cables. A qualified electrician who is familiar with battery installations and applicable building and electrical codes should install the batteries.

1. **Location**

   The system batteries install in separate battery cabinet(s). Before installing the batteries, install the LSN inverter system and any battery cabinets in their permanent location. See Section 103 to choose a location and Section 104 for instructions on securing the LSN inverter system and battery cabinets to the wall.

   CAUTION: Do not move the LSN inverter system or separate battery cabinet(s) after installing the batteries. The unit, cabinet and/or batteries may be damaged.

2. **Inter-Cabinet Connections**

   Wherever conductors may be exposed to physical damage, the conductors must be protected in accordance with NEC requirements. This includes battery cables between the LSN inverter system and battery cabinet(s) and cables between battery cabinets.

   Dual-Lite recommends routing the battery cables through the chase nipples supplied with the unit. The battery cables shipped with the unit are designed for an installation with the battery cabinet(s) installed in the standard configurations shown in Section 104.1

   IMPORTANT: If cabinets are installed in configurations other than those shown in Section 104.1, factory supplied inter-cabinet connectors and battery cables may not fit.

105.3 Battery Installation Procedure

Battery Voltage: Select which wiring diagram to use from this table

KVA Rating	1.0K	2.0K	2.7K	3.7K	4.8	5.5K	6.6K	8.3K	10.0K	12.5K	15.0K	17.5K
System DC Voltage	96	96	96	96	96	96	96	144	144	144	144	144
Number of Batteries	8	8	8	8	8	16	16	24	24	24	36	36
Battery Fuse Rating (Amps)	100	100	100	100	125	125	125	125	125	150	150	150
Wiring Diagram Fig.	1	1	1	1	1	2	2	3	3	3	4	4

Installing Batteries

NOTE: *The following procedure applies to standard Type "S" maintenance-free Lead-Calcium batteries. LSN systems specified with long-life Lead-Calcium (Free-Standing Type "G") or wet-cell Nickel-Cadmium (Type" N") batteries are supplied with Wiring Diagrams in the documentation package. Make sure all switches and circuit breakers are in the "OFF" position.*

IMPORTANT: Insure all terminal block and cable connections are tightened according to the proper torque specifications listed on pages 17 and 19 of this manual.

CAUTION: Verify that proper polarity is maintained in the wiring between the battery and electronics cabinets.
CAUTION: DO NOT INSTALL FUSE(S) IN BATTERY CABINET FUSE BLOCK(S) AT THIS TIME.
CAUTION: Orient all batteries with the positive terminals to the right as shown in the diagrams that follow.

Carefully observe battery polarity when making inter-cell and inter-tier connections.

Preliminary Wiring:

1. Install fuse block cable BC1 from left side of fuse block to left side of cabinet terminal block TB4 (POS. +) of each battery cabinet.
2. Install cable BC5 from left side of cabinet terminal block TB2 (NEG. -) of each battery cabinet. Let cable hang to bottom of battery cabinet.
3. Install inter-battery cabinet cables, BC6, to TB1 (NEG -) and TB3 (POS +) between each battery cabinet (if applicable).
4. Install battery cabinet to electronics cabinet cables, BC6, from last battery cabinet TB1 (NEG -) and TB3 (POS +) to electronics cabinet DC Input NEG and POS terminal blocks.
5. Connect inter-cabinet ground wires between all battery cabinets and electronics cabinet.
6. Route gray thermistor wire, which is coiled up and tie wire wrapped next to the DC input fuse, from electronics cabinet to one of the battery cabinets. Attach it to one of the battery cables making sure the end of the gray wire is not touching either the cabinet or any battery terminal. The chosen battery cabinet should be the one expected to get the warmest. The sensor at the end of the wires will vary the charger settings depending on battery temperature.

Bottom Level Battery Installation

1. Place four batteries in bottom of cabinet(s) with positive terminals on the right hand side.
2. Attach the three inter-cell connectors (BC3 in diagram) between cells as shown.
3. Connect BC5 from TB2 NEG. on terminal block(s) to negative terminal of battery at front left position.

Second Tier Battery Installation

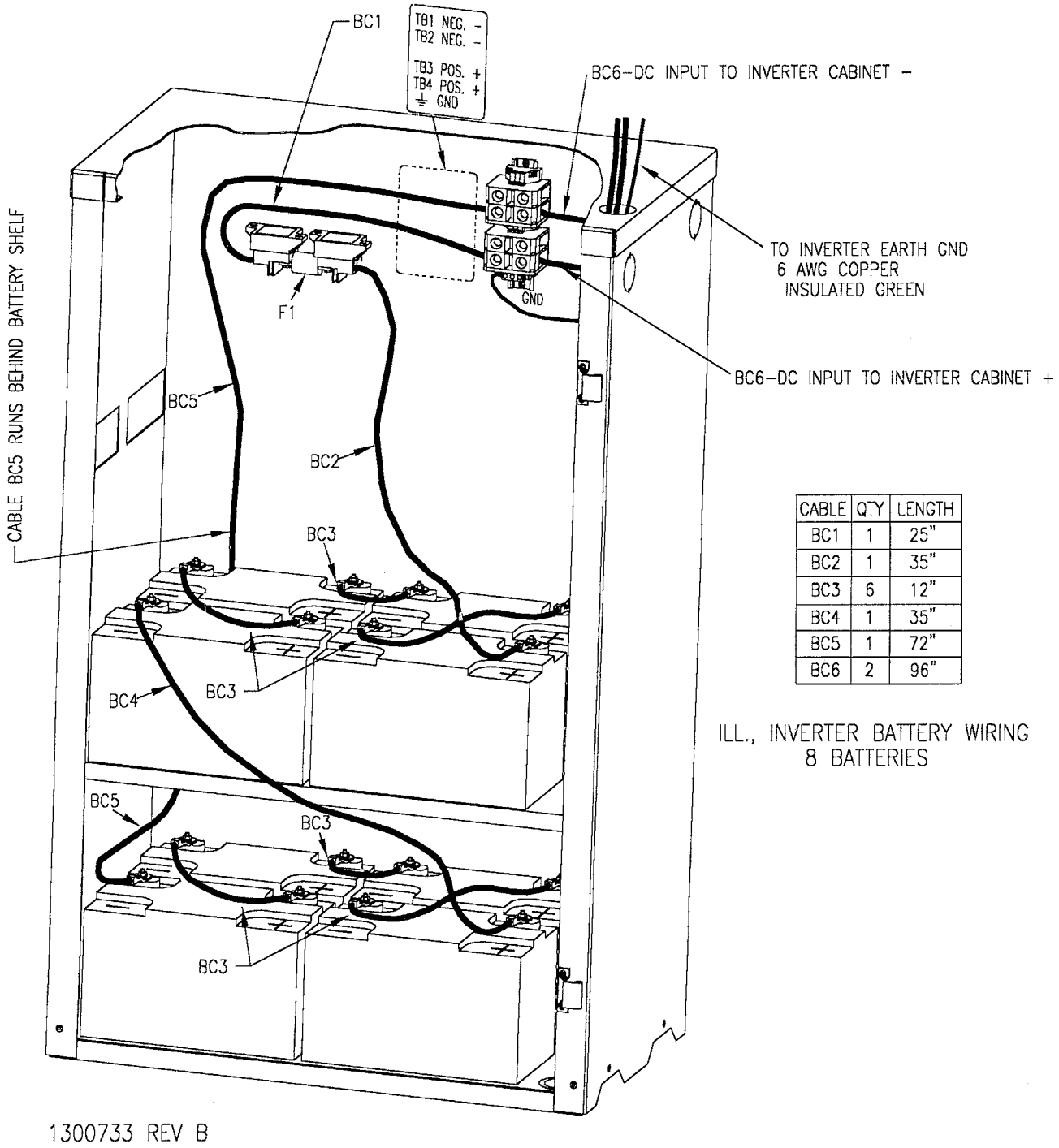
1. Install second tier shelves in cabinet(s). Be careful to keep shelf from touching battery terminals.
2. Place four batteries on second tier shelf of cabinet(s) with positive terminals on the right hand side.
3. Attach the three inter-cell connectors (BC3) between cells as shown.
4. Connect inter-tier cable(s) (BC4) from positive terminal of bottom right front cell to the negative terminal of second tier left front cell as shown.

5a. For 24 and 36 battery systems, skip to "Third Tier Battery Installation" below.
5b. For 8 and 16 battery systems, connect BC2 cable(s) between positive terminal on upper right front cell to the right side of Fuse Block F1 as shown.

Third Tier Battery Installation (24 and 36 Battery Systems Only)

1. Install third tier shelves in cabinets. Be careful to keep shelf from touching battery terminals.
2. Place four batteries on third tier shelf with positive terminals on the right hand side.
3. Attach the three inter-cell connectors (BC3) between cells as shown.
4. Connect inter-tier cables (BC4) from positive terminal of second tier right front cell to the negative terminal of third tier left front cell as shown.
5. Connect BC2 cables between positive terminal on third tier right front cell to the right side of Fuse Block F1 as shown.

Fig. 1
BATTERY WIRING DIAGRAM
8 BATTERY SYSTEMS



CABLE	QTY	LENGTH
BC1	1	25"
BC2	1	35"
BC3	6	12"
BC4	1	35"
BC5	1	72"
BC6	2	96"

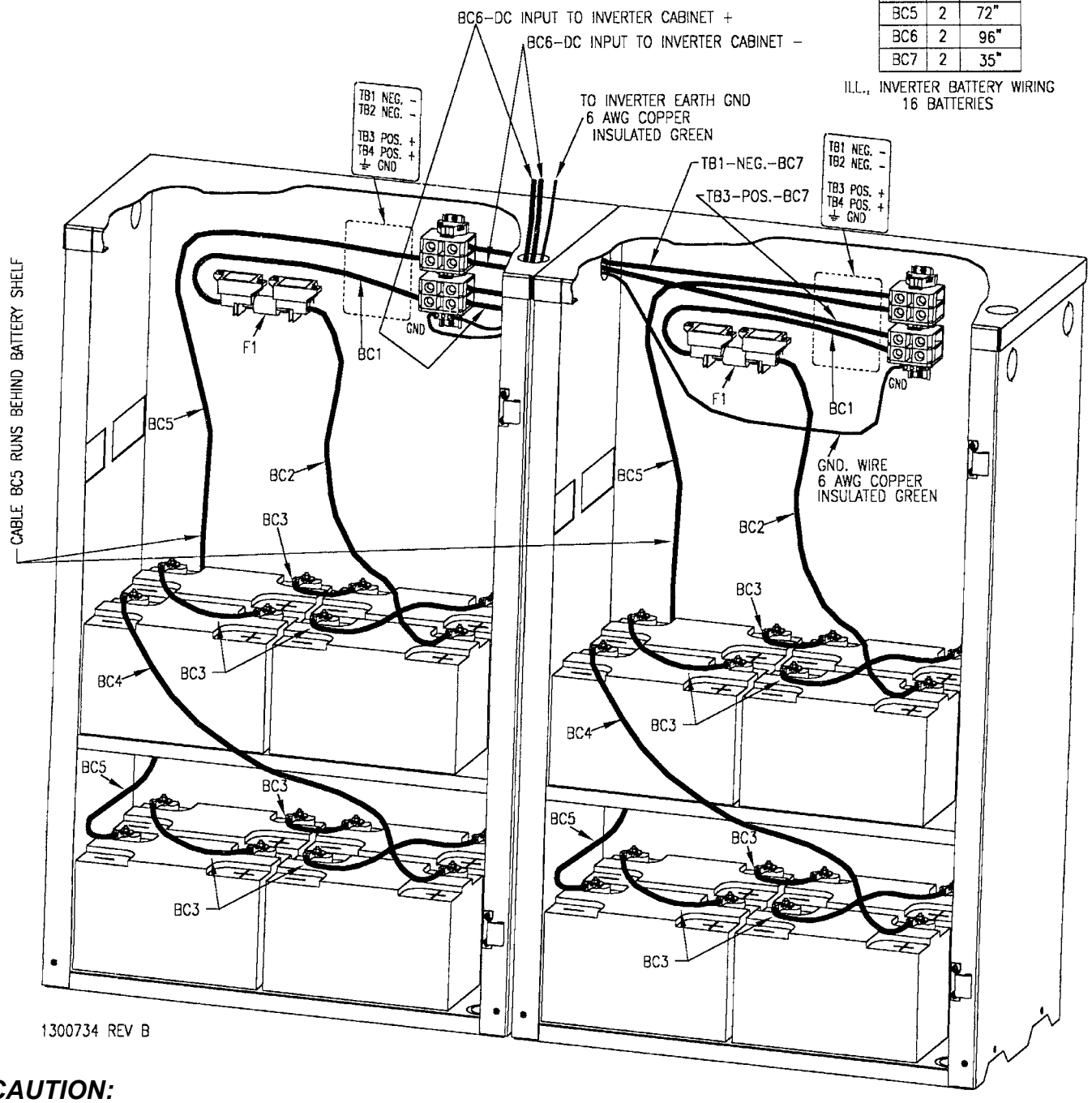
ILL., INVERTER BATTERY WIRING
8 BATTERIES

CAUTION:
Orient all batteries with the positive terminals to the right as shown in the diagram above.
Carefully observe battery polarity when making inter-cell and inter-tier connections.
Refer to page 17 for battery terminal torque specifications.

Fig. 2
BATTERY WIRING DIAGRAM
16 BATTERY SYSTEMS

CABLE	QTY	LENGTH
BC1	2	25"
BC2	2	35"
BC3	12	12"
BC4	2	35"
BC5	2	72"
BC6	2	96"
BC7	2	35"

ILL., INVERTER BATTERY WIRING
16 BATTERIES

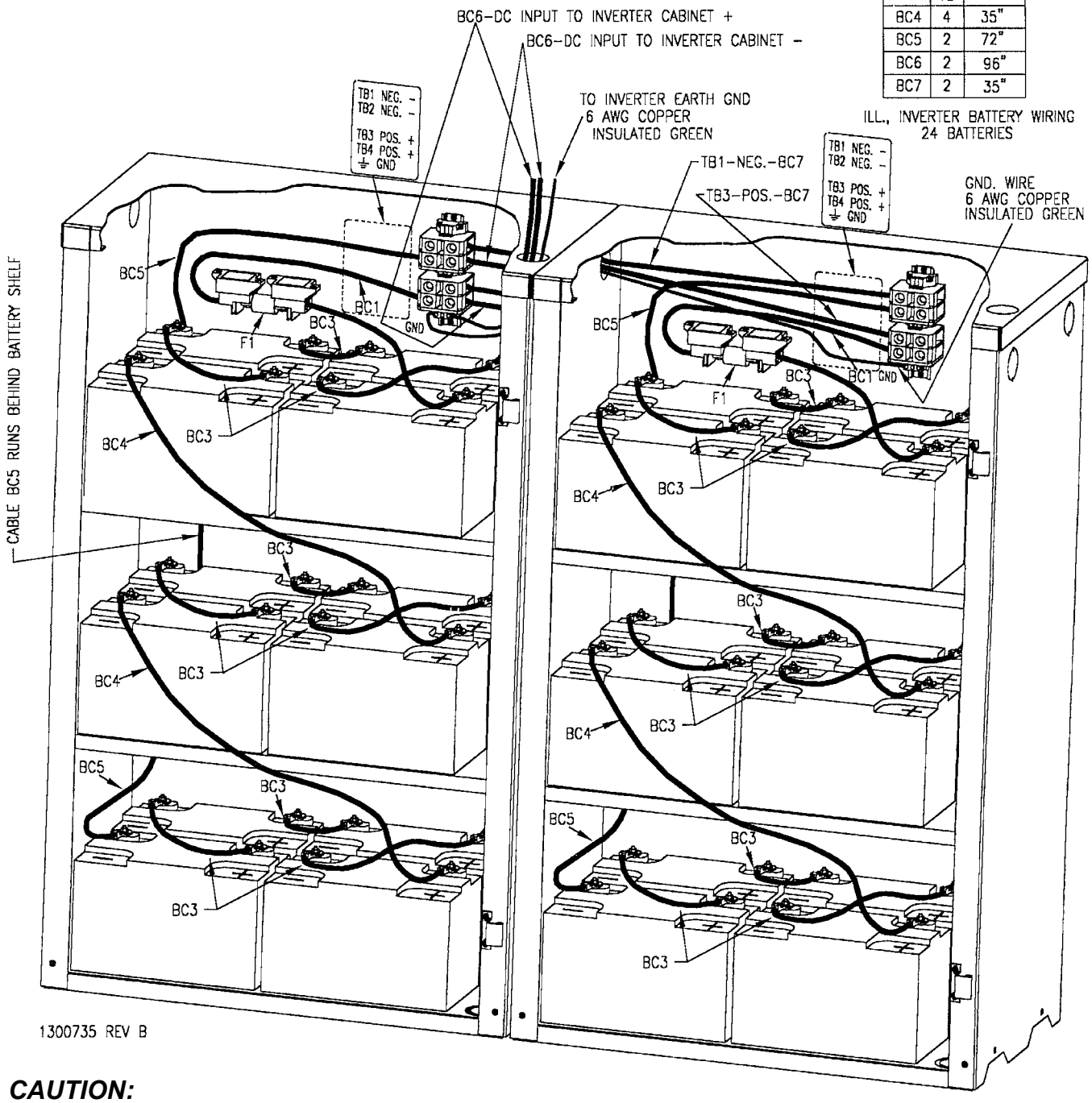


CAUTION:
Orient all batteries with the positive terminals to the right as shown in the diagram above.
Carefully observe battery polarity when making inter-cell and inter-tier connections.
Refer to page 17 for battery terminal torque specifications.

Fig. 3

BATTERY WIRING DIAGRAM
24 BATTERY SYSTEMS

CABLE	QTY	LENGTH
BC1	2	25"
BC2	2	35"
BC3	18	12"
BC4	4	35"
BC5	2	72"
BC6	2	96"
BC7	2	35"

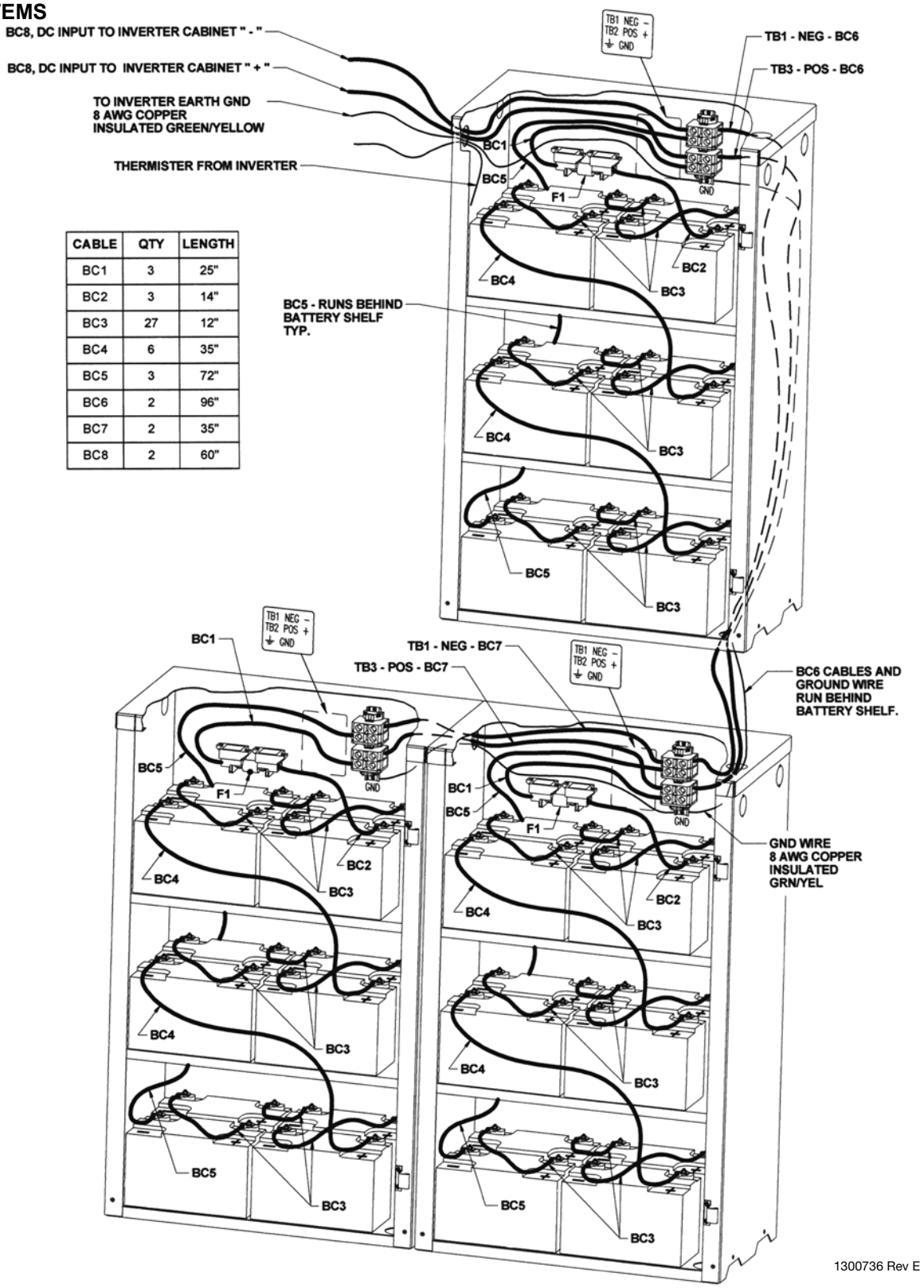


CAUTION:

Orient all batteries with the positive terminals to the right as shown in the diagram above. Carefully observe battery polarity when making inter-cell and inter-tier connections.
Refer to page 17 for battery terminal torque specifications.

Fig. 4

BATTERY WIRING DIAGRAM
36 BATTERY SYSTEMS



CABLE	QTY	LENGTH
BC1	3	25"
BC2	3	14"
BC3	27	12"
BC4	6	35"
BC5	3	72"
BC6	2	96"
BC7	2	35"
BC8	2	60"

CAUTION:
Orient all batteries with the positive terminals to the right as shown in the diagram above.
Carefully observe battery polarity when making inter-cell and inter-tier connections.
Refer to page 17 for battery terminal torque specifications.

105.4 Battery Cabinet Voltage Check and DC Fuse Installation

Note: This procedure applies to a 36 battery system. Fewer steps may be required depending on the number of batteries in the system.

Important: Always observe proper polarity when taking battery voltage measurements.

1. Using a digital volt-ohm meter (DVM), check for correct nominal battery voltage between right side of fuse block F1 and left side of battery cabinet terminal block TB2 (NEG -). Check for correct voltage in each battery cabinet.
2. Identify the battery cabinet furthest from the inverter and install battery Fuse F1. Observing proper polarity, use DVM to check for correct battery voltage between battery cabinet terminal block left side TB2 (NEG -) and TB4 (POS +). In an eight battery system, proceed to Section 105.5.
3. Identify next battery cabinet in line. Observing proper polarity, use DVM to check for correct battery voltage between next battery cabinet terminal block left side TB1 (NEG -) and TB3 (POS +).
4. Install battery Fuse F1. Observing proper polarity, use DVM to check for correct battery voltage between battery cabinet terminal block left side TB2 (NEG -) and TB4 (POS +). In a 16 or 24 battery system, proceed to Section 105.5
5. Identify last battery cabinet in line. Observing proper polarity, use DVM to check for correct battery voltage between last battery cabinet terminal block left side TB1 (NEG -) and TB3 (POS +).
6. Install battery Fuse F1. Observing proper polarity, use DVM to check for correct battery voltage between battery cabinet terminal block left side TB2 (NEG -) and TB4 (POS +).

105.5 Electronics Cabinet Voltage Check

Using a digital volt-ohm meter, check for correct nominal battery voltage between electronics cabinet DC Input NEG and POS terminal blocks. Refer to table in section 105.3 for proper system DC voltage.

Caution: Torque all connections in accordance with the following tables. Failure to do so may create an unsafe condition or fire hazard.

Battery Terminal Torque Specifications

Type "S" Batteries

Battery Part No.	Torque
93012367	30 inch-lbs.
93012368	30 inch-lbs.
93012369	110 inch-lbs.
93012370	110 inch-lbs.
93012371	110 inch-lbs.
93012372	110 inch-lbs.

Type "G" Batteries
See battery label

Type "N" Batteries

Battery Part No.	Torque
0120881, 882	66 inch-lbs.
0120883, 884	177 inch-lbs.
0120885, 886, 887, 888	265 inch-lbs.

Battery Fuse Block
275 inch-lbs.

Battery Fuse
120 inch-lbs.

106. AC Connections

CAUTION

A. All LSN inverter system units contain hazardous AC and DC voltages. Because of these voltages, a qualified electrician must install the LSN inverter system, AC line service, and batteries. The electrician must install the AC line service according to local, state and NEC codes and must be familiar with batteries and battery installation.

B. Before installing, maintaining, or servicing the unit, always remove or shut off all sources of AC and DC power and shut off the LSN inverter system. Disconnect AC line input at the service panel and turn off the Main DC Switch, the Main AC Switch, and the Master Switch to make sure the unit will not supply output voltage.

C. Whenever AC and/or DC voltage is applied, there will be AC voltage inside the LSN inverter system unit; the unit can supply power from AC line or from its batteries. To avoid equipment damage or personal injury, always assume that there may be voltage inside the LSN inverter system.

D. Remove rings, watches, and other jewelry before installing the AC wiring. Always wear protective clothing and eye protection and use insulated tools when working near batteries. Whenever servicing an energized unit with the inside panel open, electric shock is possible; follow all local safety codes. TEST BEFORE TOUCHING!

E. Before installing an external bypass switch, make sure that both the bypass switch and the AC disconnect switch are off.

F. To reduce the risk of fire or electric shock, install the LSN inverter system and the batteries in a temperature-controlled and humidity-controlled indoor area free of conductive contaminants. See Section 103 for operating environment specifications.

Preparations

1. Open the circuit breaker access door. Make sure all breakers are in the off position.

2. Make sure the LSN inverter system input and output voltages are correct for the particular application. Remember that the LSN system provides single-phase power only.

3. The input circuit breaker in the input service panel provides the means for disconnecting AC to the LSN inverter system. If using a bypass switch, the bypass enclosure also includes a separate AC Disconnect switch. Only authorized persons shall be able to disconnect AC to the unit. (See NEC 700-20 and 700-21.) Bypass switches with AC Disconnect have handles that can accept a lock to restrict control to authorized persons. If using the input circuit breaker to disconnect AC, make sure that only authorized persons have control of the circuit breaker panel to meet the requirements of NEC 700-20.

4. If installing a bypass switch, use the installation and wiring instructions supplied with the bypass switch.
   NOTE: Systems not using a bypass switch may have optional output circuit breakers and/or a normally off relay.

   CAUTION
   To prevent electrical shock or equipment damage, for all units, with and without a bypass switch, make sure the Master Switch, the Main AC Switch, the Main DC Switch on the inverter and the bypass switch (if applicable), all output circuit breakers, and the AC input at the service panel are all off before making AC connections to the LSN inverter system.

5. If not previously done, remove knockouts for AC Input and AC Output in the top of the LSN inverter system (See Figure 1 in Section 104.1).
   CAUTION: Do not drill the cabinet; drill filings may damage the unit and prevent it from operating. If larger knockouts are needed, use a chassis punch to enlarge the appropriate knockout. Do not add additional or unnecessary knockouts.

   If planning to connect a computer or terminal to the LSN inverter system unit's RS232 port, remove one of the knockouts in the top of the unit at this time (See Figure 1 in Section 104.1). If necessary, enlarge the knockout; it should be able to accept at least 1.25-inch (32 mm) conduit.

6. Install the input and output conduit.

7. **IMPORTANT:** Run the AC Input service conductors and AC Output conductors through separate conduits. Emergency output conductors and non-emergency output conductors must also be run through separate conduits. LSN inverter system emergency output circuits shall be installed in dedicated conduit systems and not shared with other electrical circuits as described in NEC 700-9(b).

106.2 AC Input and AC Output Connections

Make all AC input and output connections to the LSN inverter system as indicated on labels within the cabinet. If system was supplied with internal output circuit breaker distribution option, remove circuit breaker distribution cover and make wiring connections directly to the circuit breakers and re-install cover.

If the LSN system is to incorporate a bypass switch, it is recommended that the "Phase Check Procedure" as described in Section 109 be performed - wiring instructions are supplied with the bypass switch.

IMPORTANT: To make sure phasing is correct, make all terminal strip connections exactly as they are labeled. Good ground connections are necessary to reduce electrical noise and ensure safe operation of the LSN inverter system unit and the loads.

Caution: Torque all connections in accordance with the following tables. Failure to do so may create an unsafe condition or fire hazard.

Terminals

Terminal Width		Torque
Inches	mm	inch-lbs.
31/64	12.2	16
19/32	15.2	32
25/32	20	64

"C" Breakers

Rating	Torque
amps	inch-lbs.
10-60	25
80	34

CAUTION:

- ***Before installing the bypass switch, turn off the unit's AC input power at the service panel and turn off the bypass switch and AC disconnect switch to prevent electrical shock or equipment damage.***
- ***Before operating the bypass switch after installation, perform the Phase Check in Section 109.***
- ***DO NOT change the external bypass switch's position from UPS to Line or Line to UPS when line is present and:***
  - ***1) the UPS output is shut off or***
  - ***2) the UPS is running on battery power.***

107. RS232 Connections

All LSN inverter systems are supplied with an RS232 communications port. This port may be used for remote monitoring and control of the system.

Connecting the RS232 Port to a Computer or Terminal

Note: Connections to the RS232 port must be wired according to Class 1 wiring methods as described in NEC Section 725, Part B.

The LSN inverter system is provided with an industry standard DB-9 molded female cable. This cable is located within the LSN system inverter cabinet. Connections to the supplied DB-9 cable must be made inside the LSN inverter cabinet. A user supplied, high quality DB-9 to DB-9 or DB-9 to DB-25 communications cable must be used to make the connection between the LSN inverter system and the monitoring computer or terminal.

108. Final Installation Checklist

Important: ***Before Proceeding to the System Start-up Procedure (Section 109) Complete the Final Installation Checklist below.***

1. Insure the LSN Inverter cabinet and all battery cabinets are securely fastened together and mechanically fastened to a wall or other structure.

2. Insure that the input circuit breaker in the building service panel serving as the AC disconnect to the LSN system is in the OFF position.

3. Check for proper ground connections in all battery cabinets, the LSN Inverter cabinet, the building service panel, and the external load distribution panel.

4. Check for any loose wiring connections in all battery cabinets, the LSN Inverter cabinet, the building service panel, and the external load distribution panel.

5. Insure that all correct fuses are properly installed in each battery cabinet (See Section 105.3).

6. Check that correct nominal battery voltage (96 or 144VDC) is present in the LSN Inverter cabinet between the DC Input NEG and POS terminal blocks. Refer to Section 105.3 for proper system DC voltage.

7. On the LSN Inverter insure that the Master ON/OFF Switch, the Precharge Switch, the Main DC Switch, and the Main AC Switch are all in the OFF position.

8. Insure that the Maintenance Bypass Switch (if applicable) and all output circuit breakers are in the off position.

9. Close and lock all Battery cabinet doors.

109. Maintenance Bypass Switch Phase Check

If you are not using a bypass switch with the **LSN inverter system**, the phase check is not necessary, so you can skip this section and go directly to Section 110 to complete the system start-up. If the **LSN** unit does have a bypass switch, complete the following phase check once you have made all of the terminal strip connections and installed the batteries.

CAUTION: ***Before you switch the bypass switch from "UPS" to "AC Line," make sure you follow the steps below to check for correct operation.***

1. Make sure the main circuit breaker at the load service panel is off, or make sure the connected loads (protected equipment) cannot receive power from the LSN inverter system. Turn the bypass switch to the "OFF" position. At the AC service panel, apply power to the LSN system and the bypass switch. Turn the LSN Master ON/OFF Switch to the "ON" position. Turn the bypass switch to the "ON" position.

2. Press the precharge switch for ten seconds. Release the precharge switch and immediately turn the LSN Main DC Switch to the "ON" position.

3. Turn the Main AC Switch inside the LSN system to the **"ON"** position. The loads (protected equipment) should still be off at this time. After a short startup, the READY LED and AC-ON LED will illuminate. The LSN inverter system is ready to supply output power.

4. Make sure the voltage from the LSN system to the connected loads is close to the voltage from AC line to the bypass switch. (There may be slight differences.) To measure this, use an AC voltmeter check the voltage between the following points on the bypass switch terminal strip. (See the terminal strip label). Record the voltages below.

	AC from LSN Output	AC Line Input
(60 Hz 208 or 240VAC only)	7 to 8_____VAC	11 to 12_____VAC
(60 Hz 208 or 240VAC only)	6 to 8_____VAC	10 to 12_____VAC
(All other voltages)	7 to 8_____VAC	11 to 12 _____VAC

The voltages recorded in the first column should be similar to the voltages in the second column. The voltages may vary slightly. **If the voltage readings vary more than a few volts, shut down AC line and the LSN system. Check all connections at the terminal strip, and correct any wiring problems.** If help is required, contact Dual-Lite's Technical Support Center at 1-800-848-6439.

Important: If the AC Input voltage is 208 volts, you will normally measure 88VAC between output terminals 6 and 8. ***Never connect any 120-volt load to the 88-volt terminals.***

5. If a Break-Before-Make type bypass switch is being used, proceed to step 8.

   If a Make-Before-Break bypass switch is being used, make sure the AC voltages from the LSN system output and the AC line input are in phase. To do this, measure the AC voltage between the following points on the bypass switch terminal strip. These measurements should not be more than 100VAC; if measurements exceed 100VAC, contact Dual-Lite's Technical Support Center at 1-800-848-6439.

   (60 Hz 208 or 240 V only) 8 to 12_____VAC
   (All other voltages) 7 to 11_____VAC

6. Measure the AC voltage between the following points on the bypass switch terminal strip. This reading should not exceed 1VAC; if measurements exceed 1VAC, contact Dual-Lite's Technical Support Center at 1-800-848-6439.

   (60 Hz 208 V or 240 V) 6 to 10_____VAC
   (60 Hz 120 V or 50 Hz 220/230/240 VAC) 8 to 12_____VAC

CAUTION: If a Make Before-Break type bypass switch is being used, equipment will be damaged if the switch position is changed while AC line voltage is applied and the LSN system is turned off or operating in inverter (DC) mode. Make sure the LSN system is running on line (AC mode) and supplying output voltage before changing the bypass switch position. See the instructions supplied with your bypass switch.

7. Turn the bypass switch to the “LINE" position. Using an AC voltmeter, verify the voltage to your protected equipment load is correct. Voltage can be verified at the Load Distribution Panel.
8. Turn the bypass switch to the “UPS” position and measure the voltage to your protected equipment load once more (at the Load Distribution Panel). Verify the voltage is correct.
9. If all readings during the voltage and phase check are acceptable, reattach the bypass switch cover. Tighten the retaining screws securely. Proceed to Section 110 to complete the system start-up.

110. Start-Up Procedure

FACTORY START UP: A Factory Start Up is provided standard with this unit. Please contact Dual-Lite's Technical Support Center.

IMPORTANT: ***The LSN inverter system is a sophisticated electronic back-up power supply. Care must be taken to follow the steps below in their exact sequence. Failure to do so will result in erroneous alarm messages and possible equipment failure.***

CAUTION: Familiarize yourself with the shut down procedure in section 300.1 before proceeding with the Start Up.

1. **Turn on the input circuit breaker in the building service panel serving as the AC disconnect to the LSN system and check for proper voltage and phasing on the AC Input terminal block.**
2. **Turn on all output circuit breakers in the external Load Distribution Panel.**
3. **Close and lock the main cabinet door to the LSN Inverter cabinet.**
4. **Open the LSN system Circuit Breaker access door.**
5. **Turn on the output circuit breakers (if any).**
6. **Turn on the LSN Master On/Off Switch. Caution: This is a locking toggle type switch. Pull it out towards you to move it to the "ON" position.**
7. **Hold the Pre-charge Switch in the "ON" position for 10 seconds.**
8. **Release the Pre-charge Switch and immediately turn ON the Main DC Switch.**
9. **Turn on the Main AC switch.**
10. **After approximately five seconds, the system should turn on, the lighting loads should be energized, the front panel "AC-ON" and "READY" LEDs should illuminate, and the system LCD display will begin to scroll the system parameters.**
11. **Depending on the state of charge of the batteries, the front panel Charging LED may illuminate.**

111. System Verification

At this point, the connected load should be energized, the "Ready" and "AC On" LEDs should be lit, and the display is scrolling through 18 operating messages. Wait 2 minutes while the system completes its final set up, and then look at the various messages and make sure they are within expected limits. If any alarms sound, go to section 205 for further instructions. If you need assistance, call Dual-Lite's Technical Support Center at **800-848-6439**.

If no alarms sound, perform the following inverter test to verify its operation:

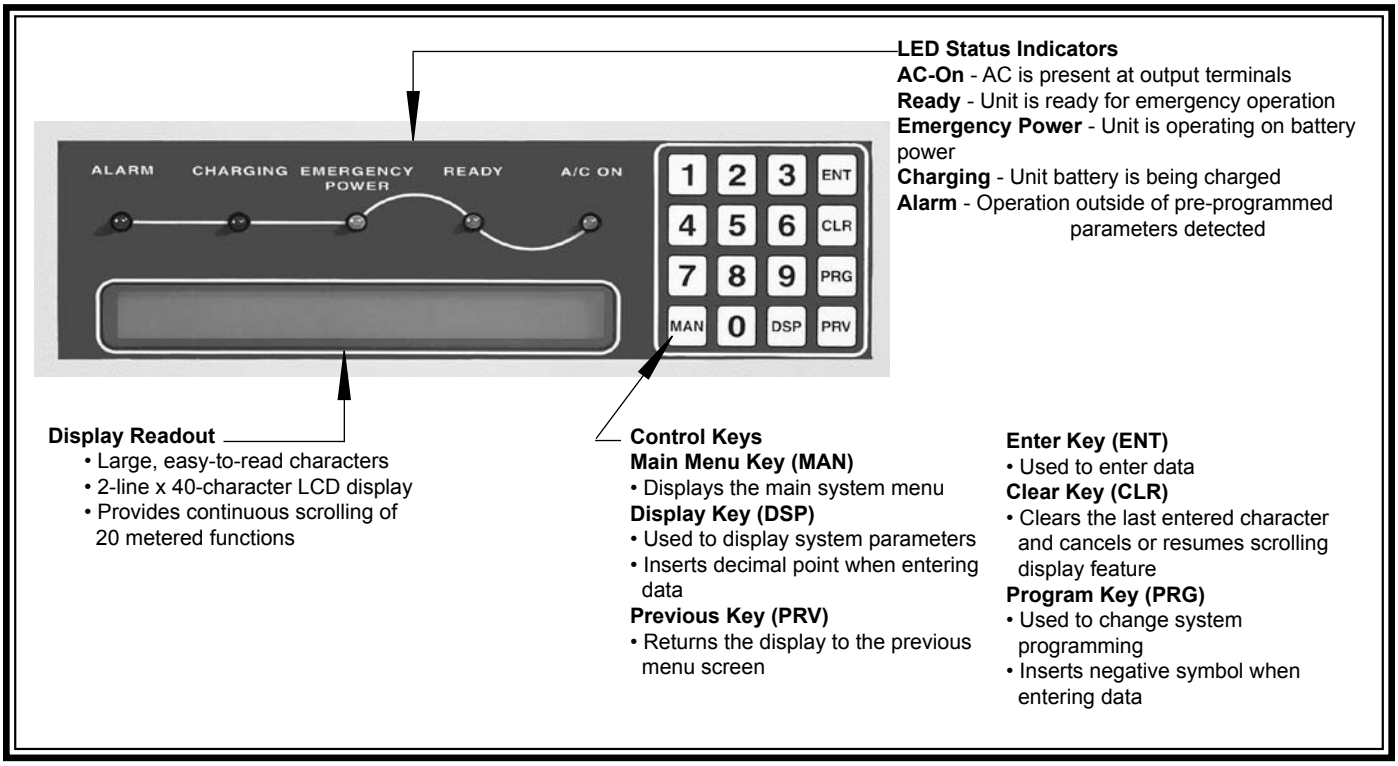
Once the “Ready” LED is illuminated, simulate a power failure by opening the AC input circuit breaker. The inverter and the cooling fans will begin operating. All connected loads should be energized and operational, HID fixtures should not “wink-out”.

Allow the inverter to run for several minutes or until satisfied with its operation. Close the AC input breaker to end the test and return the unit to standby mode.

Note: *It will take a few seconds for the unit to re-synchronize with the input line. The inverter will turn off when synchronization is achieved.*

Section 200 User Manual

201. User Interface Panel Basics


LED Status Indicators
AC-On - AC is present at output terminals
Ready - Unit is ready for emergency operation
Emergency Power - Unit is operating on battery power
Charging - Unit battery is being charged
Alarm - Operation outside of pre-programmed parameters detected
ALARM
CHARGING
EMERGENCY POWER
READY
A/C ON
1 2 3 ENT
4 5 6 CLR
7 8 9 PRG
MAN 0 DSP PRV
Display Readout
• Large, easy-to-read characters
• 2-line x 40-character LCD display
• Provides continuous scrolling of 20 metered functions
Control Keys
Main Menu Key (MAN)
• Displays the main system menu
Display Key (DSP)
• Used to display system parameters
• Inserts decimal point when entering data
Previous Key (PRV)
• Returns the display to the previous menu screen
Enter Key (ENT)
• Used to enter data
Clear Key (CLR)
• Clears the last entered character and cancels or resumes scrolling display feature
Program Key (PRG)
• Used to change system programming
• Inserts negative symbol when entering data

Located on the inverter cabinet's front door, the user interface panel allows the user to monitor and control the LSN system. The microprocessor-controlled display includes an array of LED indicator lights, a 2-line x 40-character digital display and a coded keypad to display over 250 system parameters, operating modes, alarms and stored logs.

Menu-Driven Display

The LSN user interface provides a menu-driven display that allows access to all system information through the following four primary sub-menus:

- ***Meters***
- ***User Programming***
- ***Logs***
- ***Factory Programming***

The menu-driven display provides users with a structured, intuitive method of accessing system information. The display is a user-friendly interface allowing easy access to all system programming, operating parameters, meters and logs. The interface design utilizes numeric "Hot Keys" for each parameter to access data.

Password Protection

To ensure that only authorized personnel operate the unit, every LSN system is password protected. No control functions can be accessed or operating parameter changes made without a valid six-digit password authentication.

LSN Inverter systems provide multi-level password protection. Each progressive level allows changes to increasingly

The User Password is factory set at **944944** and is user programmable.
See section 201.3 for procedure for clearing a User Password.

201.1 Using The Interface Panel

The User Interface Panel is used to display over 250 system parameters, operating modes, alarms and stored logs. When the correct password is entered, the user can also change system modes and parameter values.
If the wrong key is pressed at any time, press (CLR) and then the correct key. The control panel will beep each time you press a key.

Before changing parameter settings or system modes, a user password must be entered. User password consist of six, user selected, numeric digits. The user password is stored in parameter 178 and can be user defined by following the "How To Change A Parameter Value" in Section 200.2.3

201.2 How To Display A Parameter

1. Press **[DSP]**
2. Enter the desired parameter number
3. Press **[ENT]**

For example, to display parameter 7 (Battery Volts & Charging Current), follow these steps:

User Keypad Actions	Display Readout
[DSP]	Enter Display Code setup value
7	Enter Display Code setup value 7
[ENT]	More Battery Meter Functions (5) Battery 108.2 V, Battlin 1.2 A

201.3 How To Clear A User Password

Once a password has been entered, it can be cleared in one of the two following ways:

1. If the User Interface Panel remains inactive for a period of 30 minutes, the password will be automatically cleared.
2. Press **[PRG] 233** to display the password parameter menu. The display will present prompt "1" to cancel all passwords. Press **1, [ENT]** to clear password.

201.4 How To Change A Parameter Value

NOTE: *Only certain parameters are user changeable. Refer to the complete parameter listings on the following pages; user changeable parameters are shown in boldface.*

1. Press **[PRG]**
2. Enter the desired parameter number
3. Enter the user password (if not already active)
4. Press **[ENT]**
5. Enter the new parameter value and press **[ENT]**

For example, to change parameter 0 (time) to 9:30 a.m., follow these steps:

User Keypad Actions	Display Readout
[PRG]	Enter Control Code Setup Value
0	Enter Control Code Setup Value 0
[ENT]	Password Required Please enter 6-Digit user password
******	Enter Control Code Setup Value 0
[ENT]	Time 14:00:00 Enter Time (HH:MM:SS) __:__:__
093000[ENT]	Time 14:00:00 Enter Time (HH:MM:SS) 09:30:00

IMPORTANT: The "TIME" (parameter 0) and "DATE" (parameter 10) must be set by user in order for system to operate properly.

201.5 How To Change Operating Modes

There are four available operating modes:

1. Off = System Off

2. Line = AC Pass-Through

3. Auto = Standby Operation

4. On = Inverter On (Emergency Battery Operation)

The LSN inverter system will select the appropriate operating mode automatically upon start-up.

NOTE: Changing the operating mode may prevent the LSN system from operating during a power failure.

To change the system operating mode to *Inverter Mode*, follow these steps:

1. Press **[PRG]**
2. Enter the parameter number “150”
3. Enter the user password (if not already active)
4. Press **[ENT]**
5. Enter the desired operating mode identifier and press **[ENT]**

User Keypad Actions	Display Readout
[PRG]	Enter Control Code setup value
150	Enter Control Code setup value 150
[ENT]	Password Required Please enter 6-digit user password
******	Enter Control Code setup value 150
[ENT]	User Inverter Mode Control Menu Off(1) Line(2) AUTO(3) On(4)
4 [ENT]	Inverter Line Command Sent Off(1) Line(2) AUTO(3) On(4)

201.6 Parameter "Hot Key" Listing By Function

User changeable parameters are shown in boldface.

Metered Parameters:

Time & Date	(0,10)
Input Voltage & Frequency	(1)
Output Voltage & Current	(2,4)
Volt-Amps, Watts and % of Full Load	(5,16,17)
Battery Volts & Charging Current	(7)
Input frequency	(8)
Run Time Remaining	(9)
Battery & Ambient Temperature	(11)
Transformer and Heatsink temperature	(12,14)
Output Power factor & Crest Factor	(27)
System Hours	(22)
Inverter time since startup	(23)
Output Frequency	(192)
Last Inverter Run Time	(210)

System Parameters:

Unit ID string. Remote entry only (20 char)	(15)
Max allowed VA	(19)
System Hours Display/Reset	(22)
Minimum DC volts since startup	(30)
Maximum DC volts since startup	(31)
Minimum AC input volts	(32)
Maximum AC input volts	(33)
Minimum AC output volts	(34)
Maximum AC output volts	(35)
Minimum output VA	(36)
Maximum output VA	(37)
Factory Serial Number	(40)
Nominal Frequency	(42)
Nominal Input Voltage	(43)
Nominal Output Voltage	(44)
Rated VA	(45)
Rated Watts	(46)
Console Baud Rate	(95)
Nominal Battery Voltage	(219)
Nominal Run Time Minutes.	(236)

Charger Control:

Charger Type Selected	(122)
Batt Chg Lower on Volts	(124)
Battery Reduced Float Volts	(125)
Battery Chg Upper Off Volts	(126)
Charger Dropout Current Number	(215)
Charger Trickle Current Number	(216)
Nominal Battery Voltage	(219)
Batt Equalization Volts	(220)

Inverter Control:

Low Input Frequency switch point	(51)
High Input Frequency switch point	(52)
Inverter Off, Line, Auto, or On	(150)

Alarms:

High VA Overload alarm setpoint	(19)
Low Output Volts alarm setpoint	(59)
High Output Volts alarm setpoint	(61)
High Input Volts alarm setpoint	(62)
Low Input Volts alarm setpoint	(170)
Low Battery Volts alarm setpoint	(65)
Near Low Battery volts alarm setpoint	(66)
High Battery volts alarm setpoint	(67)
Low Run Time alarm setpoint	(68)
High Ambient Temp alarm setpoint	(80)
High Heatsink Temp alarm setpoint	(82)
Low input frequency alarm setpoint	(164)
Alarm Acknowledge and Silence	(181)
High Battery Temp Alarm setpoint	(195)
High Transformer Temp alarm setpoint	(84)
Alarm Query	(228)

Logs:

Inverter Log	(24)
Alarm Log	(25)
Test Results Log	(26)
Service Log	(154)
Battery Volts Log	(155)
Battery Discharge Volts Log	(156)
Power Log	(157)
Peak Values Log	(158)
Diagnostic Log	(161)

Shutdown:

Low Output Volts shutdown setpoint	(60)
High Ambient Temp shutdown setpoint	(81)
High Heatsink Temp Shutdown setpoint	(83)
High Transformer Temp Shutdown setpoint	(85)
High Output Volts shutdown setpoint	(172)
VA Overload Shutdown setpoint	(198)

NOTE: ***See "Appendix 1" in back of manual for numeric order listing of parameter hot keys along with keyboard alpha alternates and password protection levels.***

201.6 Parameter “Hot Key” Listing By Function

User changeable parameters are shown in boldface.

Monthly, Yearly Test & Equalize Time Setup:

Time of Day for Monthly test	(73)
Date for Monthly test	(127,128)
Monthly Test Time Duration	(129)
Annual Test Time Duration	(130)
System Test Fax Request Status	(152)
Monthly Reschedule Interval	(183)
Date for Annual test	(184)
Time of Day for Annual test	(185)
Annual Reschedule Interval	(186)
Start Monthly test	(182)

Options, Relays:

Inverter Active Relay Delay	(89)
Alarm Active Relay Delay	(260)
Normally Open Relay 3 Off Delay	(261)
Normally Open Relay 4 Off Delay	(262)

Miscellaneous:

Software Version	(137)
Change User Password	(178)
Cancel All Passwords	(233)

202. System Self-Diagnostics

Self-testing/self-diagnostic electronics perform continuous testing of subsystems, insuring performance to prescribed operating parameters. Operation outside of prescribed limits or system malfunctions will result in an alarm indication on the system's user interface display panel. Depending on the type of alert, the panel alarm indication may be visual or audiovisual.

User-programmable discharge tests are automatically performed on a monthly and annual basis. Date, time and duration of these tests can be programmed to meet state, local authority and individual requirements.

All testing events are automatically logged in memory and can be displayed on the user interface panel.

203. System Auto Testing

The LSN inverter system automatically performs three sophisticated, microprocessor-controlled system discharge tests; a weekly test, a monthly test and an annual test. The following parameters affect these tests:

Weekly test	**Monthly Test**	**Annual Test**
• Schedule (264)	• Time of day for monthly test (73)	• Time of day for annual test (185)
	• Date for monthly test (127)	• Date for annual test (184)
	• Monthly test duration (129)	• Annual test duration (129)
	• Monthly reschedule interval (183)	• Annual reschedule interval (186)

203.1 Weekly Test

Every week (at a time and date specified in parameter 264) the system will automatically operate the inverter for one minute. During this test, the system will monitor inverter output and connected load. The unit automatically records the results of the test in parameter 26, which can be displayed from the user interface panel.

203.2 Monthly Test

Every month (or at the interval specified in parameter 183) the LSN Inverter System automatically performs a discharge test to check battery capacity and emergency inverter operation. The duration of the monthly test cycle is controlled by parameter 129, set at the factory for 5 minutes. The unit automatically records the results of the test in parameter 26, which can be displayed from the user interface panel.

203.4 Annual Test

Once a year, the unit automatically performs a battery exercise cycle/discharge test by running the unit in emergency mode for 90 minutes. It is recommended that it be scheduled at a time when the area protected by the LSN system will be unoccupied for a full 48 hours to allow the batteries time to recover to full capacity. The date on which the annual test takes place is stored in parameter 184 .

203.4 Extended Power Outages

During extended power outages, the LSN inverter system will provide power to all connected loads for its full rated discharge time.

NOTE: During emergency operation of the LSN system, parameter 9 allows the user to determine how many minutes of runtime remain in the normal discharge period. At a set number of minutes prior to the end of the runtime (factory default setting is 30 minutes), the unit will sound a "Low Runtime" alarm. The unit may also simultaneously sound a "Near Low Battery" alarm. When either of these alarms occur, an orderly shutdown of any non-emergency equipment that may be connected to the system should be conducted in order to allow the inverter to operate critical emergency equipment for a longer period of time.

Following the normal discharge period, the unit will continue to operate normally until battery capacity reaches a pre-set disconnect limit. At this point, the inverter will automatically disconnect inverter AC output power to the load. The unit's electronic controls will remain powered by the system batteries until the batteries reach a second pre-set low imit at which point the unit will shut down completely to prevent deep discharge damage to the unit batteries.

203.5 Performing a Manual Test

Manual 5-minute tests may be performed at any time using the following procedure:

1 Press [PRG], 182, [ENT].

2. Display will read "Password Required"
3. Press "944944" (or current user defined password), [ENT].
4. Display will read "Start Immediate Monthly Systest Menu, Start (1)"
5. Press "1".
6. Display will read "Monthly Test Started"

The LSN system will operate in inverter mode for five minutes. The unit automatically records the results of the test in parameter 26, which can be displayed from the user interface panel.

204. Stored Test Results (Logs)

Logs - What They Mean And How To Read Them

System logs may be accessed at any time by pressing [DSP] and the "Hot Key" designator for the Log you wish to view. All logs are displayed in a scrolling fashion, starting with the most current event. Since each entry is displayed for only 2 seconds, it may be necessary to pause the scrolling for a closer look. This can be done by pressing "0" when the event you wish to stop at is displayed on the screen. To go the next entry press "1". To resume the scrolling mode, press "0" again. To view another parameter, simply push [DSP] and the "Hot Key" designator at any time.

The following presents what each log looks like, and how to read them:

Service Log (Hot Key # 154)

Logs password levels entered or changed, system resets necessary due to alarmed shutdowns, and FAX messages status (if so equipped). Retains the last 20 entries.

081200 09:55 Serv Pwd Entered

081200 09:18 User Pwd Entered

081200 09:05 FAX sent

First six digits are the date; the next four are the time in Military format. Next is the event.

Test Results Log (Hot Key # 26)

Logs start time and pass/fail status of all system tests. Retains the last 20 entries.

081200 11:20 MT Pass 0H 5M 0S

081200 11:16 MT Load: 654 VA

081200 11:15 MT Start

In interpreting this log, use the same procedure as the Service Log. The weekly test will be shown as WT, monthly test as MT, the yearly test as YT. The digits following the pass/fail messages represent how long the test lasted in hours, minutes and seconds.

Inverter Log (Hot Key # 24)

Logs the last 20 inverter events, including on/off times and run duration.

081200 13:47 INVOFF 1H 50M 6S

081200 11:56 INV ON 3

The date and time format in this log is the same as the others, but here we are keeping track of how many times the inverter turns on by simply adding a counter after the "INV ON" message. Duration format is the same as in the "Test Result Log". The above is telling us the inverter turned on for the 3rd time on 8/12/2000 at 11:56 AM and turned off 1 hour 50 minutes 6 seconds later at 1:47 PM (13:47 in Military time).

Battery Voltage Log (Hot Key # 155)

An hourly log of the systems total battery voltage and the charging current. Retains the last 48 entries.

081200 13:00 BatV 108.1 V ChgI 0.1 A

081200 12:00 BatV 108.1 V ChgI 0.1 A

081200 11:00 BatV 108.1 V ChgI 0.1 A

Battery Discharge Voltage Log (Hot Key # 156)

Logs the total battery voltage, at 5-minute intervals, while system is in inverter mode. Also displays the duration of the power failure and the system's output VA. This type of information is very useful in determining battery performance.

Retains the last 40 entries.

081200 11:48 0H 9M 102.4V 231 VA

081200 11:43 0H 5M 101.5V 237 VA

081200 11:38 0H 0M 107.2V 225 VA

The above shows the power failure occurred at 11:38, initial battery voltage was 107.2 volts, the output load was 225 VA. The power failure lasted 9 minutes, a battery voltage was taken at the 5-minute mark, and ending voltage after the 9 minutes was 102.4 volts.

Power Log (Hot Key # 157)

Continuously monitors the connected load total power consumption (in VA) and records a reading every minute. Retains the last 30 entries.

081200 13:33:52 223 VA-min

081200 13:32:52 223 VA-min

081200 13:31:52 223 VA-min

Peak Value Report (Hot Key # 158)

Records peak system parameter readings for AC input voltage, AC output voltage, AC output current, battery voltage and output VA.

ACVin observed max: 119 min: 115

ACVout observed max: 119 min: 115

ACIout observed max: 5 min: 5

VA observed max: 690.2 min: 646.4

BatteryV observed max: 114.5 min: 103.2

Diagnostic Status Report (Hot Key # 161)

Continuously monitors and logs internal microprocessor communication status. The information contained in this log is to be used by factory trained technicians only.

Alarm Log (Hot Key # 25)

Logs the last 25 system alarms, the type of alarm, on/ off times and their duration. The system's alarms will be covered in more depth in Section 205. At this point, we will simply show you what the log looks like and how to read it.

081200 15:29 CLR CktBrkr Trip ALM

081200 15:29 ALM Ckt Brkr Trip

062100 14:55 CLR ACVout Lo ALM

062100 14:55 ALM ACVout Lo 0 101

Each entry shows which alarm was activated and when. It also shows when the alarm cleared. In cases such as line 4, when the alarm activated because of a reading was either too low or too high, the log will show what the reading was and where the trip point is set. In this example, the system detected a low AC output, it measured 0 volts - trip point was set at 101 volts.

205. Alarms

What They Mean And How To Respond

When the LSN system detects a problem, it:

- ***Sounds an alarm***
- ***Illuminates the red "ALARM" LED on the User Interface Panel, and***
- ***Displays an error message***

If the system was ordered with an optional e-mail device and the alarm condition lasts for more than five minutes, the unit will automatically send an alarm e-mail to all programmed e-mail locations.

In The Event Of An Alarm Condition

1. Read the user interface panel display to determine the specific alarm condition.
2. Temporarily silence the alarm by pressing **[MAN],3,2** on the user interface panel. The display should read "Alm Silenced". This procedure silences the indicated alarm only. Should another failure be detected, the alarm for that condition will sound.
3. Find the message or code in the following table. The table provides alarm information and appropriate response procedures.

For illustration purposes, the model used is a 120-volt in, 240-volt out, 15 KVA unit operating with a nominal battery bank of 144 volts DC. The first number in the alarm messages is the actual measured value, the second is the preset limit. This table is offered as a guide only, other factors may cause the various alarms to activate.

NOTE - Whenever contacting the Dual Lite Technical Support Center, it is desirable to use a telephone as close to the system as possible in order to help our technicians determine the cause of the alarm condition.

Alarm Message	What it means	What to do
ALM Lo ACVin 99 102	AC voltage fed to unit fell below allowable limits.	Verify input AC is low with an external voltmeter. If yes, call electrical contractor to Troubleshoot and repair the service feeds. If no contact Dual Lite's Technical Support Center.
ALM Hi ACVin 140 134	AC voltage fed to unit is above allowable limits.	Verify input AC is high with an external voltmeter. If yes, call electrical contractor to troubleshoot and repair the service feeds. If no contact Dual Lite's Technical Support Center.
ALM Htsnkt Hi 150C 100C	Heatsink temperature rose above allowable limit.	Contact Dual Lite's Technical Support Center.
ALM BattT Hi 70C 60C	Battery cabinet temperature rose above allowable limit.	If batteries are installed in a hot environment (above 50C), relocate them. If not, call Dual Lite's Technical Support Center.
ALM Low Runtime 29 30	Unit is about to shut down.	Remove non-critical loads to extend runtime.
ALM Freq Lo 49 58	Output frequency is below allowable limit.	If alarm occurs in standby mode, problem is with the incoming feed. If alarm occurs in Inverter mode, contact Dual Lite's Technical Support Center.
ALM ACVout lo 200 204	System is still operating, but output voltage fell below allowable limit.	Contact Dual Lite's Technical Support Center.
ALM ACVout Hi 272 269	System is still operating, but output voltage rose above allowable limit.	Make sure there is a minimum 5% load connected to the unit. If not, make arrangements to do so. If load is proper, contact Dual Lite's Technical Support Center.
ALM XfmrT Hi 102C 100C	Output transformer is overheating and unit is about to shut down.	Call Dual Lite's Technical Support Center.

Alarm Message	What it means	What to do
ALM VA Hi 16218 15000	Unit has detected an overload and is about to shut down.	Remove some of the load until alarm clears.
ALM I2C Comm	Microprocessor failure.	Contact Dual-Lite's Technical Support Center.
ALM BattV Hi 182 177	Battery voltage is too high.	Shut down the unit and contact Dual-Lite's Technical Support Center.
ALM BattV Lo 125 127	Battery voltage is too low. If unit is in Inverter mode it is about to shut down.	If charger light is on, allow condition to persist for 24 hours. If alarm does not clear, contact Dual-Lite's Technical Support Center.
ALM BattV Nr Lo 130 132	Battery voltage is near Low level.	Same as above.
ALM AmbT Hi 62C 60C	Ambient temperature within the electronics	If unit is located is a hot environment, relocate If not, contact Dual-Lite's Technical Support Center.
ALM CktBrkr Trip	One or more output circuit breaker has tripped.	Locate tripped breaker and reset. If it trips again check load circuit for shorts.
LCL SHTDN XfmrT Hi	System has shut down because output transformer has overheated.	Contact Dual-Lite's Technical Support Center.
LCL SHTDN Htsnk Hi	System has shut down because inverter heatsink has overheated.	Contact Dual-Lite's Technical Support Center.
LCL SHTDN AC Out Over Current	System has shut down due to high output current.	Reduce load.
SHTDN VA Ovrld 23110 22500	System has shut down. Overload is greater than 50% of the rated of the unit.	Reduce load.
SHTDN VA5 Ovrld 19111 18000	System is overloaded by at least 20%. It has been in this condition for 5 minutes and then shut down.	Reduce load.
SHTDN VA10 Ovrld 17200 16500	System is overloaded by at least 10%. It has been in this condition for 10 minutes and then shut down.	Reduce load.
SHTDN ACVout Lo 187 192	System has shut down due to low AC output voltage.	Contact Dual-Lite's Technical Support Center.
SHTDN XfmrT Hi 122C 120C	System has shut down due to transformer overheating.	Contact Dual-Lite's Technical Support Center.
SHTDN AmbT Hi 82C 80C	System has shut down due to overheating in the electronics cabinet.	Contact Dual-Lite's Technical Support Center.
SHTDN Htsnk Hi 123C 120C	System has shut down due to overheating if the inverter heatsink.	Contact Dual-Lite's Technical Support Center.
ALM Battery Charger Failure	Charger is not functioning.	Contact Dual-Lite's Technical Support Center.
ALM Annual Test Failed	System failed the 90-minute annual test	Some of the batteries may have failed. Run a manual discharge and evaluate battery performance. Call Dual-Lite's Technical Support Center.
ALM Monthly Test Failed	System failed the monthly 5-minute test	Some of the batteries may have failed. Run a manual discharge and evaluate battery performance. Call Dual-Lite's Technical Support Center.
Weekly Test Failed	System failed the 1-minute test	May have been caused by a decrease of more than 10% of the connected load. Load change message will appear at parameter #26. Check connected load and address any issues accordingly.

206. Communications

Each LSN system is supplied with a DB-9/RS232 communication port enabling the user to communicate with the equipment from a remote location. Owner must supply the connecting cable with a DB-9 Male end, and the appropriate connector at the other for the COM port used on the PC. Follow instructions supplied with the PC to set up communications through a terminal emulation program such as Hyper Terminal on Windows '95, '98. Settings for the COM port should be set for 19200bps, 8 data bits, 1 stop bit, flow control - none.

Entering Commands:

Once connected, the PC monitor will mimic the same scrolling parameters that are displayed on the User Interface Panel. To initiate commands from your keyboard, you must first hit the "Enter" key twice. The screen will display "Communications Re-Enabled". Commands may now be entered.

Appendix 1 shows a list of commands available through the RS232 connection. There are three types of parameters, Display, Program, and Both. Depending as to which type of parameter you are trying to access, one of the following methods must be followed:

- Display (Dsp) Parameters are "view only" parameters and can be accessed by typing d(space) and the Hot Key number. Example; d 7 "Enter" will display the battery voltage

- Program (Pr) Parameters are values that will change the operating specifications of the system. A password is required to access any these, the more critical the function, the higher of a level password will be required. These can be viewed by typing p(space) and the Hot Key number. Example: p 150 "Enter" will display the operating mode of the unit, after you have entered your user password.

- Both parameter types are accessible using either method above. Keep in mind that if you wish to change a setting for a parameter of type "Both", you will first be required to enter your password.

Miscellaneous Commands:
"com","cmd" or "command" lists selected commands
"st", "sts" or "ststus" shows a formatted live update screen of selected metered data.
"stsf" shows the same screen but in a fixed status.
"pa", "par" or "param" lists all parameters that are type Dsp or Both.

207. Unit Communication Options

E-mail Device Option (EML)

The E-mail device is an option that automatically notifies the user(s) of system test results and alarm conditions. This is accomplished by sending a detailed e-mail to up to six e-mail asddresses.

Purpose:
This option allows for remote monitoring via network connection, notification of alarm conditions by e-mail and reporting all system tests to technical support and 5 additional addresses.

Description:
System is comprised of a single board computer with factory-installed software and a CAT5 Ethernet connection port.

Installation:
Entire system is factory installed and service technician activated.

- Requires CAT5 cable supplied by customer connected to the site's network server.
- E-mail Option Setup Checklist will need to be completed and sent to Dual-Lite by installer in order to ensure that e-mail is setup by the time of startup. If the information is not available by the time of startup, a follow up visit by an authorized service technician can be scheduled to setup the feature.

The e-mail device automatically sends an e-mail to the addresses programmed whenever:

- The unit performs a weekly, monthly or annual system test
- The unit sounds an alarm

NOTE: Communication option installation and wiring instructions are provided in the print package supplied with the unit.

208. Service Options

Factory Start-Up

Factory Start-Up is provided standard.

Service Agreement (PMP)

Provides for an annual visit by a factory-authorized technician to test all system options and related accessories. Technician will perform a physical and mechanical inspection of all batteries and battery connections. Included will be a test, calibration and recording of the system charger output, battery float voltages and all input/output settings. Technician will also perform a simulated power outage, discharging the batteries to 87.5% of nominal voltage and record readings of individual battery voltages.

Monitoring Program (MP)

Requires Factory Start-Up (FS) and E-mail Device (EML) options.
It provides for the continuous monitoring of the equipment by our Technical Support Group. All monthly and yearly system tests will be reviewed and analyzed for early warning signs of system malfunctions. Any failures will be automatically relayed to our Technical Support Center where corrective action can be taken. This Monitoring Program is the only automated failure reporting system in the industry. It requires a CAT5 Ethernet cable to be connected to the customer's network.

NOTE: Service Options may be purchased by contacting your Dual-Lite distributor or Authorized Service Center.

300. Maintenance

300.1 Safe Shut Down Procedure

CAUTION

To avoid possible equipment damage or personal injury, assume that there is AC voltage present inside the LSN inverter system unit any time AC input power or DC battery voltage is applied. The inverter is capable of providing output voltage from the batteries even when there is no AC input line voltage. When AC input voltage is present, the unit can provide output voltage even when the batteries are disconnected.

AC AND DC VOLTAGES WILL BE PRESENT INSIDE THE UNIT UNTIL LINE AC IS DISCONNECTED AND ALL INTERNAL SWITCHES ARE TURNED OFF.

Do not touch components inside the unit. DC voltage is always present at the batteries and battery cables.

If an external bypass switch is not used, turn off all connected equipment (loads) at their source and proceed to "Final Shut Down Procedure" below.

A. Bypass Switch Disconnect

If the unit utilizes a bypass switch, check the label to determine whether it is Break-Before-Make or Make-Before-Break.

Follow the instructions for the type of switch identified:

Break-Before-Make: If a Break-Before-Make (BBM) external bypass switch is used, the switch will temporarily break input power as it switches from emergency inverter power to utility power (LINE) or back to CIS power.

1. Shut down all connected equipment (loads)
2. Turn the bypass switch to the LINE position.
3. If necessary, restart connected equipment.

Make-Before-Break: If a Make-Before-Break (MBB) bypass switch is used.

1. Make sure the AC Line light is on
2. Make sure the "Emergency Power" light on the user interface panel is **off**.
3. The LSN system must be providing utility AC pass-through to the connected equipment.

CAUTION:

If a Make-Before-Break bypass switch is used, equipment will be damaged if the switch position is changed when line is applied and the LSN system is operating in the "Off" or "On" (Emergency Battery Operation) Mode. See the instructions packed with the bypass switch.

4. Turn the bypass switch to the LINE position.

B. Final Shut Down Procedure

1. Open the unit's front door.
2. Turn off the Master Switch, the Main DC Switch, the Main AC Switch and any Output Circuit Breakers.

CAUTION: HAZARDOUS ENERGY IS STORED IN CAPACITORS INSIDE THE LSN UNIT. AFTER TURNING OFF SWITCHES, ALLOW 5 MINUTES FOR CAPACITORS TO DISCHARGE BEFORE ATTEMPTING ANY SERVICE PROCEDURES.

3. If the service technician does not need to access the inside of the unit, close and lock the unit's front door.
4. If the unit will be shut off for an extended period of time, recharge the batteries every 60 to 90 days.

CAUTION: The batteries will be damaged and the warranty voided if not routinely recharged.

NOTE: To turn power back on, follow the "System Startup Procedure" outlined in Section 110. Be sure to complete all of the steps to assure the unit will operate properly.

300.2 Routine System Maintenance

The LSN inverter system unit is designed to provide years of trouble-free operation. Its self-testing/self-diagnostic microprocessor will check the batteries and inverter regularly to ensure proper operation.

The unit does require some routine attention to assure peak performance. Dual-Lite recommends a Preventative Maintenance check be performed by a qualified service technician at least every six months. The technician must observe important safety precautions while performing the following recommended tasks:

- ***Inspect and clean the unit interiors;***
- ***Inspect and record any Alarm and Inverter Logs;***
- ***Inspect all batteries for leaks, case swelling or terminal corrosion;***
- ***Check the AC and DC meter functions and recalibrate if necessary;***
- ***Perform an emergency operation test to check operation of all critical connected loads;***
- ***Check the values of metered parameters and system logs,***
- ***Change air filters*** *(see below).*

NOTE: ***If the LSN unit is installed in an area where audible alarm signals may not be heard, a weekly visual check is advised.***

300.3 Changing Air Filters

CAUTION
This procedure must be done by a qualified service person ONLY!
Based on the installation environment, LSN inverter system air filters should be changed at least every six months to assure sufficient airflow to prevent overheating of unit electronics.

To change unit air filters, follow these steps:

1. Follow the steps in Section 207.1 to safely shut down the unit. Remember to leave the system door closed for at least five minutes to allow capacitors to discharge.
2. After five minute period, open the system door.
2. Remove old filters which are held in place by double-sided adhesive tape.
3. Clean off any tape adhesive residue from back of door.
4. Replace filters using Dual-Lite Filter Kit
5. Close the system door.
6. Follow the “System Startup Procedure” outlined in Section 109. Be sure to complete all of the steps to assure the unit will operate properly.

300.4 Battery Maintenance and Replacement

This section provides precautions for qualified service personnel working with unit batteries. No user serviceable parts are within the system's cabinets

Important Safety Precautions

The service technician must take these precautions:

1. **Wear protective clothing, eye-wear, rubber gloves and boots. Batteries contain corrosive acids or caustic alkalis and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry. Don't carry metal objects in pockets where the objects can fall onto the batteries or into the LSN inverter system or battery cabinet.**

2. **Tools must have insulated handles so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at any time. Do not lay tools or metal parts on top of the batteries, and do not lay any objects where they could fall onto the batteries or into the cabinet.**

3. **Install the batteries as shown on the battery wiring diagram provided in this manual or with the battery cable kit. When connecting cables, never allow a cable to short across a battery's terminals, the string of batteries, or to the cabinet.**

4. **Align the cables on the battery terminals so that the cable lug will not contact any part of the cabinet even if the battery is moved. Keep the cable away from any sharp metal edges.**

5. **Install the battery cables so they cannot be pinched by the battery cabinet or the LSN inverter system doors.**

6. **External battery cabinet chassis ground (or earth) must be connected to the LSN inverter system unit's chassis ground (or earth). The ground conductor must be insulated. If you use conduit, this ground conductor must be routed in the same conduit as the battery conductors.**

7. **Where conductors may be exposed to physical damage, protect conductors in accordance with NEC requirements.**

8. **If replacing batteries or repairing battery connections, follow the procedure in this manual to shut down the LSN inverter system and remove both AC and DC input power.**

9. **Full voltage and current are always present at the battery terminals. The batteries used in this system can produce dangerous voltages, extremely high currents, and possible risk of electric shock. Batteries may cause severe injury if the terminals are shorted together or to ground (earth). Be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminals during battery installation. Do not touch uninsulated battery terminals.**

10. **A qualified electrician who is familiar with battery systems and required precautions must install and service the batteries. Any battery used with this unit shall comply with the applicable requirements for batteries in the standard for emergency lighting and power equipment, UL 924. Cabinets are designed to be used with, and batteries must be replaced by identical cells or a Dual-Lite approved equivalent. If using substitute batteries not supplied by Dual-Lite, the unit's UL listing will be void, and the equipment may fail to perform properly. The installation must conform to national and local codes as well. Keep unauthorized personnel away from batteries.**

CAUTION:
A battery can present a risk of electrical shock and high short circuit current. Battery replacement should only be performed by qualified service personnel familiar with battery systems. All safety precautions outlined at the beginning of this section must be observed when servicing, maintaining or replacing batteries

Routine Battery Inspection and Maintenance

Sealed Lead-Calcium Batteries (Includes Type S and Type G batteries)

Lead-Calcium cells are the most common type of battery used today in standby equipment. By design it is as maintenance free as a battery can be. Coupled with the diagnostic and self-testing capabilities of the LSN system, these batteries provide one of the most reliable and carefree inverter systems available today. It is recommended, however, that some simple steps be taken to increase system life and maximize reliability:

- If system is installed in a remote area where the system's alarms may not be heard, it is recommended that the system be checked weekly for alarm conditions,
- A quarterly visual check of the batteries should be conducted to look for deformities in the cases and terminal corrosion. Any defective batteries should be replaced. All corroded terminals, regardless how slight, are to be cleaned and retightened at once to prevent failure of the entire battery bank.
- Once a year, all battery connections should be checked for tightness and re-torqued if necessary. Torque specifications can be found on the battery label.

Nickel-Cadmium Batteries

Used in harsher environments, the wet nickel cadmium battery is designed for a 25-year life. When properly maintained it will give years of reliable performance. Care must to be taken to maintain adequate electrolyte levels and terminal cleanliness. Use only distilled water when necessary. Never use any kind of acid to refill the battery, serious damage and injury may occur.

The same frequency and procedures as listed above for the lead-calcium batteries should be followed.

If you have any questions, contact Dual Lite's Technical Support Center at 1-800-848-6439.
Please dispose of all batteries properly.

Battery Replacement Procedure

WARNING: Always use the same quantity and type of battery as replacements.
Substituting batteries not supplied by Dual-Lite will void the UL listing of the system and may cause equipment failure. To ensure the superior performance of your LSN inverter system and to maintain proper charger operation, replace spent batteries only with Dual-Lite cells having the same part number, voltage and ampere-hour rating as the original batteries.

1. Follow the proper shut down procedure as described in Section 300.1.
2. Remove battery cabinet fuses and test them for continuity. Faulty fuses will prevent batteries from charging and render the battery bank useless during a power outage.
3. Break down the battery bank beginning with the intercell connectors. These cables tie the batteries installed on the same shelf together.
4. Next remove the inter-tier cables. These cables connect the batteries located on different shelves together.

5. Remove the batteries from the cabinet. Batteries can be very heavy, use proper lifting methods when removing battery.

6. Install new batteries following the instructions outlined in Section 105.3.

Battery Disposal

WARNINGS:
Do not dispose of batteries in a fire, the batteries could explode.
Do not open or mutilate batteries.
Released electrolyte is highly toxic and harmful to the skin and eyes.

CAUTION:
Batteries contain lead. Many state and local governments have regulations about used battery disposal. Please dispose of the batteries properly. For help, contact the Dual-Lite Technical Support Center.

301. Warranty Information

WARRANTY

The system is guaranteed, under normal and proper use, against defects in workmanship and materials for a period of two years from the date of shipment. Batteries supplied as part of the system are covered under a separate pro-rata warranty as described below:

Batteries - 1 year plus pro-rata period

Pro-Rata Periods -
Lead-Calcium (Type S) - 9 years
Lead-Calcium (Type G) - 14 years
Nickel-Cadmium (Type N) - 14 years

IMPORTANT:
Lengthy storage of batteries will cause irreversible damage to the cells.
Failure to connect LSN inverter system batteries to an energized charging circuit within 90 days from the date of shipment will void the battery warranty.

302. Technical Service and Support

During or after installation, Dual-Lite's Systems Technical Support Center is available to provide expert assistance. Our service representatives are available to answer customers' questions or solve their problems.

Toll-Free Number

A toll-free phone has been set up for LSN technical assistance. The number is: **1-800-848-6439.**
Service representatives are available during normal working hours (EST).

Appendix 1.
Parameter "Hot Key" Numerical Listing

Param. No.	Type	Keyboard Alpha	Password Level	Description
0	Both	t	User	Time
1	Dsp	vi	N/A	Input Voltage
2	Dsp	vo	N/A	Output Voltage
4	Dsp	o	N/A	Output Current
5	Dsp	va	N/A	Volt-Amps Out
6	Dsp	ib	N/A	Battery Supplied Current
7	Dsp	vb	N/A	Battery Volts & Charging Current
8	Dsp	vi	N/A	Input Frequency
9	Dsp	rt	N/A	Run Time Remaining
10	Dsp	d	User	Date
11	Dsp	at	N/A	Ambient Temperature
12	Dsp	st	N/A	Heatsink Temperature
14	Dsp	xt	N/A	Transformer Temperature
15	Both	id	User	Unit ID string. Remote entry only (20 char)
16	Dsp	l	N/A	Percent of Full Load
17	Dsp	w	N/A	Watts Output
18	Dsp	pf	N/A	Output Power Factor
19	Both	val	Serv	High VA Overload alarm setpoint
20	Dsp	po	N/A	Power Outages
21	Dsp	ol	N/A	Overloads
22	Both	sh	Fact	System Hours Display / Reset
23	Both	im	Fact	Inverter Minutes since startup/Reset
24	Dsp	il	N/A	Inverter Log
25	Dsp	al	N/A	Alarm Log
26	Dsp	tr	N/A	Test Results Log
27	Dsp	cf	N/A	Crest Factor
28	Both	bl	Serv	Brownout Level
30	Both	mind	N/A	Minimum DC volts since startup
31	Both	maxd	N/A	Maximum DC volts since startup
32	Both	minvi	N/A	Minimum AC input volts
33	Both	maxvi	N/A	Maximum AC input volts
34	Both	minvo	N/A	Minimum AC output volts
35	Both	maxvo	N/A	Maximum AC output volts
36	Both	minva	N/A	Minimum output VA
37	Both	maxva	N/A	Maximum output VA
40	Both	sn	Fact	Factory Serial Number
42	Dsp	nf	N/A	Nominal Frequency
43	Both	nvi	Fact	Nominal Input Voltage
44	Both	nvo	Fact	Nominal Output Voltage
45	Both	rva	Fact	Rated VA
46	Both	rw	Fact	Rated Watts
51	Both	lf	Serv	Low Input Frequency switch point
52	Both	hf	Serv	High Input Frequency switch point
59	Both	lvoa	Serv	Low Output Volts alarm setpoint
60	Both	lvos	Serv	Low Output Volts shutdown setpoint
61	Both	hvoa	Serv	High Output Volts alarm setpoint
62	Both	hvia	Serv	High Input Volts alarm setpoint
65	Both	lb	Serv	Low Battery Volts alarm setpoint
66	Both	nlb	Serv	Near Low Battery volts alarm setpoint
67	Both	hb	Serv	High Battery volts alarm setpoint
68	Both	lr	Serv	Low Run Time alarm setpoint
73	Both	tt	User	Time of Day for Monthly test
78	Both	ae	Diag	Alarm Shutdown E/D
80	Both	ats	Serv	High Ambient Temp alarm setpoint
81	Both	ats	Serv	High Ambient Temp shutdown setpoint
82	Both	hta	Serv	High Heatsink Temp alarm setpoint
83	Both	hts	Serv	High Heatsink Temp Shutdown setpoint
84	Both	xta	Serv	High Transformer Temp alarm setpoint
85	Both	xts	Serv	High Transformer Temp Shutdown setpoint
89	Both	ird	User	Inverter Active Relay Delay
95	Both	cb	Serv	Console Baud Rate
110	Both	cvin	Fact	AC V in Gain
111	Both	cvid	Fact	AC V in Offset
112	Both	cvon	Fact	AC V out Gain
113	Both	cvod	Fact	AC V out Offset
114	Both	caon	Fact	AC Amps Out Gain
115	Both	caod	Fact	AC Amps Out Offset
116	Both	cdvn	Fact	DC Volts Gain
117	Both	cdvd	Fact	DC Volts Offset
118	Both	cdan	Fact	Inverter Current Gain
119	Both	cdad	Fact	Inverter Current Offset
120	Both	ccn	Fact	Charger Current Gain
121	Both	ccd	Fact	Charger Current Offset
122	Both	ct	Fact	Charger Type
123	Both	mc	Fact	Charge Current Setpoint Number
124	Both	lcv	Fact	Batt Chg Lower On Volts
125	Both	fcv	Fact	Battery Reduced Float Volts
126	Both	hcAv	Fact	Batt Chg Upper Off Volts
127	Both	mtd	User	Date for Monthly test
128	Both	mtd	User	Date for Monthly test
129	Both	mtt	Fact	Monthly Test Time Duration
130	Both	att	Fact	Annual Test Time Duration
137	Dsp	sv	N/A	Software Version
150	Prg	inv	User	Inverter off, line, auto, on
151	Both	lre	Serv	E/D Low Run Time Alarm
152	N/A	N/A	N/A	Reserved For Factory Use
153	Dsp	op	N/A	Compile Options
154	Dsp	sl	N/A	Service log
155	Dsp	bvl	N/A	Battery volts log
156	Dsp	bdl	N/A	Battery discharge volts log
157	Dsp	pl	N/A	Power log
158	Dsp	pvl	N/A	Peak values log
159	Prg	tled	Diag	LED relay diag test
160	Prg	clr	N/A	Clr peak values
161	Dsp	drl	N/A	Diagnostic Report Log
162	Both	ibe	N/A	Inverter beep On/Off
163	Both	edw	User	E/D Weekly Test
164	Both	lfa	Serv	Low Input Freq Alarm setpoint
165	Both	lfe	Serv	Enable/Disable Low Inp Freq Alm
166	Both	lvoe	Serv	E/D Low Output Volts Alarm
167	Both	lvse	Serv	E/D Low Output Volts Shutdown

Appendix 1.
Parameter “Hot Key” Numerical Listing

Param. No.	Type	Keyboard Alpha	Password Level	Description
168	Both	hvoe	Serv	E/D Hi Output Volts Alarm
169	Both	hvie	Serv	E/D Hi Input Volts Alarm
170	Both	lvia	Serv	Low Input Volts Alarm Setting
171	Both	lvie	Serv	E/D Low Input Volts Alarm (Default is Disabled)
172	Both	hvos	Serv	Hi Output Volts Shutdown Setting
173	Both	hvse	Serv	E/D Hi Output Volts Shutdown
174	Both	lbe	Serv	E/D Low Battery Volts Alarm
175	Both	nlbe	Serv	E/D Near Low Battery Alarm
176	Both	hbe	Serv	E/D Battery Hi Volts Alarm
177	Prg	csp	Serv	Change Service Password
178	Prg	cup	User	Change User Password
179	Prg	cfp	Fact	Change Factory Password
180	Prg	cdp	Diag	Change Diagnostic Password
181	Prg	ack	N/A	Acknowledge and Silence Alarms
182	Prg	smt	User	Start Monthly Test
183	Both	mta	User	Monthly Test AutoResched
184	Both	atd	User	Annual Test Date
185	Both	ath	User	Annual Test Time of Day
186	Both	atr	User	Annual Test AutoResched
187	Prg	res	N/A	Resume Scroll
188	Both	ate	Serv	E/D Hi Amb Temp Alarm
189	Both	xte	Serv	E/D Hi Transformer Temp alarm
190	Both	ase	Serv	E/D Hi Amb Temp Shutdown
191	Both	hte	Serv	E/D Hi Heatsink Temp Shutdown
192	Dsp	of	N/A	Output Frequency
193	Both	hhe	Serv	E/D High Heatsink Temp alarm
194	Both	vae	Serv	E/D High VA Overload alarm
195	Both	bta	Serv	High Battery Temp alarm setpoint
196	Both	bte	Serv	E/D High Battery Temp alarm
197	Both	xse	Serv	E/D Transformer Hi Temp Shutdown
198	Both	vas	Serv	VA Overload Shutdown setpoint
199	Both	vse	Serv	E/D VA Overload Shutdown
200	Both	fx1	User	Destination Fax #1
201	Both	fx2	User	Destination Fax #2
202	Both	ff	User	Fax From #
203	Prg	eep	Serv	Copy System to/ Clear Eeprom/Step 2
204	Both	eda	Serv	E/D Audible Alarm
205	Both	edi	Serv	E/D I2C Alarm
206	Both	edc	Serv	E/D Circuit Breaker Trip Alarm
207	Both	ed	Serv	Equalize Date
208	Both	et	Serv	Equalize Time of Day
209	Both	er	Serv	Equalize Auto Reschedule Months & Days
210	Dsp	it	N/A	Last Inverter Run Time
211	Both	pim	Fact	ACI peak Gain
212	Both	pib	Fact	ACI peak Offset
213	Both	mtm	Fact	Monthly Test Resched Max
214	Both	atm	Fact	Annual Test Resched Max
215	Both	cdc	Fact	Charger Dropout Current
216	Both	ctc	Fact	Charger Trickle Current
217	Both	edu	Fact	Equalize Duration Time
218	Both	erm	Fact	Equalize Resched Max
219	Both	nbv	Fact	Nominal Battery Voltage
220	Both	ev	Fact	Batt Equalization Volts
221	Both	bte	Serv	Inverter Boost Trip Point (Brownout Level)
222	Both	bhe	Serv	Inverter Boost Hysteresis
223	Both	ivo	Serv	Inverter High Volts On Setpoint
224	Both	ipo	Serv	Inverter Out Pot Setpoint
225	Both	iv	Serv	Inverter Out Volts Setpoint
226	Both	be	Serv	Inverter Blank Adjust (Not Used)
227	Prg	co	Diag	Diag Charger On/Off
228	Dsp	aq	N/A	Alarm Query
229	Both	ic	Diag	Inverter Cycling On/Off
230	Both	fp1	User	Fax #1 Prefix
231	Both	fp2	User	Fax #2 Prefix
232	Both	N/A	Serv	E/D Echo
233	Prg	cap	User	Cancel All Passwords
234	Prg	fng	None	Fax Failed. Serv Log entry from
235	Prg	fok	None	Fax OK. Serv Log entry from
236	Both	nrt	Serv	Nominal Run Time Minutes.
237	Prg	vim	Fact	AC V in Gain AutoCal
238	Prg	vib	Fact	AC V in Offset AutoCal
239	Prg	vom	Fact	AC V out Gain AutoCal
240	Prg	vob	Fact	AC V out Offset AutoCal
241	Prg	aom	Fact	AC Amps Out Gain AutoCal
242	Prg	aob	Fact	AC Amps Out Offset AutoCal
243	Prg	bvm	Fact	Battery DC Volts Gain AutoCal
244	Prg	bvo	Fact	Battery DC Volts Offset AutoCal
245	Prg	icm	Fact	Inverter Current Gain AutoCal
246	Prg	ico	Fact	Inverter Current Offset AutoCal
247	Prg	ccm	Fact	Charger Current Gain AutoCal
248	Prg	cco	Fact	Charger Current Offset AutoCal
249	Prg	apm	Fact	ACI Peak Gain AutoCal
250	Prg	apb	Fact	ACI Peak Offset AutoCal
251	Prg	es	Serv	Stop Equalize
252	Both	fx3	User	Destination Fax #3
253	Both	fx4	User	Destination Fax #4
254	Both	fx5	User	Destination Fax #5
255	Both	fx6	User	Destination Fax #6
256	Both	fp3	User	Fax #3 Prefix
257	Both	fp4	User	Fax #4 Prefix
258	Both	fp5	User	Fax #5 Prefix
259	Both	fp6	User	Fax #6 Prefix
260	Both	ard	User	Alarm Active Relay Delay
261	Both	no3	User	Normally Open Relay 3 Off Delay
262	Both	no4	User	Normally Open Relay 4 Off Delay
263	Both	edb	Serv	E/D Battery Charger fail Alarm
264	Dsp	wtd	N/A	Weekly test Sched
265	N/A	N/A	N/A	Reserved For Factory Use
266	Both	iam	User	IP addressing mode
267	Both	ipa	User	IP address

Appendix 1.
Parameter “Hot Key” Numerical Listing

Param. No.	Type	Keyboard Alpha	Password Level	Description
268	Both	gwa	User	Gateway address
269	Both	snm	User	Subnet mask
270	Disp	em1	N/A	E-mail address 1
271	Both	em2	User	E-mail address 2
272	Both	em3	User	E-mail address 3
273	Both	em4	User	E-mail address 4
274	Both	em5	User	E-mail address 5
275	Both	em5	User	E-mail address 6
276	Both	tmz	User	Time zone
277	Both	mhd	User	Mail hub domain name
278	Both	epn	User	SMTP port number
279	Both	tls	User	TLS-secured message
280	Both	usr	User	Authorized user
281	Both	pwd	User	Authorized user password
END				

Notes:

Notes:

1300736

DUAL LITE

A Hubbell Lighting, Inc. brand with representatives' offices in principal cities throughout North America.

Copyright © Hubbell Lighting, Inc. All Rights Reserved. Content subject to change without notice.

Printed in U.S.A. 0601681 J 10/09